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Characterization of MWC (Municipal Waste Combustion) Ashes and Leachates from MSW (Municipal Solid Waste) Landfills Monofills, and Co-Disposal Sites. Volume 6

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Characterization of MWC Ashes and Leachates from MSW Landfills, Monofills, and Co-Disposal Sites

Volume VI of VII

Characterization of Leachates from Municipal Waste Disposal Sites and Co-Disposal Sites

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VOLUME VI OF VII

Prepared for

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ACRONYMS AND DEFINITIONS

BNA	Base-neutral and Acid Extractables
BOD	Biological Oxygen Demand
CAS	Chemical Abstract Service
CB	Chlorobiphenyl
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COD	Chemical Oxygen Demand
Codisposal	Disposal together of municipal solid wastes and municipal solid waste combustion ashes
CP	Chlorinated Phenols
DWE	Deionized Water Extraction Test Method
EP	Extraction Procedure
EPA	U.S. Environmental Protection Agency
ESP	Electrostatic Precipitator
HSWA	Hazardous and Solid Waste Amendments
HWC	Hazardous Waste Combustion
LF	Landfill
MCL	Maximum Contaminant Level
Monofill	A landfill that contains only solid waste combustion ashes and residues
MSW	Municipal Solid Waste
MW	Monitoring Well
MWC	Municipal Waste Combustion
MWEP	Monofilled Waste Extraction Procedure, also known as SW-924
ND	Not Detected
NPDES	National Pollutant Discharge Elimination System
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls

ACRONYMS AND DEFINITIONS
PAGE TWO

PCDDs	Polychlorinated dibenzo-p-dioxins
PCDFs	Polychlorinated dibenzofurans
POTW	Publically Owned Treatment Works
RCRA	Resource Conservation and Recovery Act
RDF	Refuse Derived Fuel
RPD	Relative Percent Difference
SS	Suspended Solids
SW-924	Deionized Water Extraction Test Method
TCLP	Toxic Characteristics Leaching Procedure Test Method
TDS	Total Dissolved Solids
TEF	Toxic Equivalency Factors
TNK	Total Nitrogen Kjeldahl
TOC	Total Organic Carbon
TSCA	Toxic Substances Control Act

1.0 INTRODUCTION

1.1 BACKGROUND INFORMATION

This report on characterization of leachates from municipal waste disposal sites and codisposal (municipal and municipal-waste-combustion solid residue) sites is prepared to provide support to EPA's study of the Subtitle D Program. The study described in this report is one of a series of investigations designed to assist EPA in developing data to evaluate the potential effects on humans and the environment from leachates generated by such municipal landfills.

Three reports issued by NUS under the same work assignment summarize the available literature information regarding the characteristics of leachates from municipal landfills.

1. Characterization of Municipal Landfill Leachates - A Literature Review, September 1986 (Volume II of this report).
2. Addendum to Characterization of Municipal Landfill Leachates - A Literature Review, March 1987 (Volume III of this report).
3. Characterization of Municipal Waste Combustion Residues and Their Leachates - A Literature Review, July 1987 (Volume IV of this report).

The third report summarizes the literature information regarding the chemical characteristics of municipal-waste-combustion (MWC) solid residues, their leaching characteristics when exposed to various leaching tests, and the characteristics of leachates from monofilled MWC residue landfills (Volume IV of this report).

In 1979, under authority of Sections 1008(a)(3) and 4004(a) of Subtitle D of the Resource Conservation and Recovery Act (RCRA), EPA promulgated "Criteria" for determining whether specific Subtitle D (nonhazardous waste) disposal facilities and practices pose a reasonable probability of adverse effects on human health or the environment (40 CFR Part 257). Major provisions of the Criteria include prohibitions on adverse effects on endangered species, discharges to surface water, and groundwater contamination. Those facilities that violate the Criteria are "open dumps" and are prohibited under RCRA.

In 1979, EPA also promulgated guidelines for the development of State Solid Waste Management Plans (40 CFR Part 256). These guidelines required that states seeking EPA Subtitle D grant funds have the authority to prohibit, close, and upgrade open dumps. These grant funds were available from 1977 to 1981. State participation in this program was voluntary. Outside of approval of the state plans and disbursement of grant funds, EPA had no direct implementation authority. Thus, Subtitle D has basically been a state-administered program.

Federal funding of state Subtitle D activities was terminated after 1981. Since then, the focus of EPA's efforts under RCRA has been upon the Subtitle C (hazardous waste) provisions. As a result, EPA has little current information on the status of state nonhazardous waste programs or on the Subtitle D facilities themselves.

The Hazardous and Solid Waste Amendments (HSWA) to RCRA, signed into law on November 8, 1984, require EPA to submit a report to Congress by November 8, 1987, addressing whether the Subtitle D Criteria (40 CFR Part 257) are adequate to protect human health and the environment from groundwater contamination, and recommending whether additional authorities are needed to enforce the Criteria. Further, EPA must revise the Criteria by March 31, 1988, for facilities that may receive hazardous household waste (HHW) or small-quantity-generator (SQG) waste. These revisions are to include groundwater monitoring, location restrictions, and corrective active, as appropriate.

Within 18 months of the promulgation of the revised Criteria, each state must develop a permit program or other system of prior approval to ensure that each facility that may receive hazardous household waste or small-quantity-generator waste is in compliance with the Criteria. The HSWA envision Subtitle D to continue to be State implemented. However, if the states fail to enforce the Criteria, EPA may intervene.

Since 1984, studies conducted by EPA in support of the report EPA must submit to Congress, have raised concerns regarding the chemical composition of leachate generated from municipal waste landfills. These concerns center on the detection of certain toxic inorganic constituents (mainly metals) and organics, and on the lack of available data for a comprehensive and defensible evaluation of the effects of leachates on human health and the environment.

1.2 OBJECTIVES OF STUDY

This study on characterization of leachates from municipal waste disposal sites and codisposal sites was designed to provide information for the EPA report to Congress. Specifically, the objectives of this study were as follows:

- To select four municipal waste disposal sites and sample their leachates (minimum of three samples per site).
- To select two codisposal sites (MSW disposal sites in which municipal incinerator ashes also are disposed of) and sample their leachates (minimum of three samples per site).
- To sample Municipal Waste Combustion (MWC) ashes arriving at the two selected codisposal sites for disposal.
- To analyze all collected leachate samples for the compounds on the RCRA Appendix IX list at a qualified, experienced, and competent laboratory.
- To subject the collected MWC ashes to the three most commonly applied leaching tests.
    - The EPA Extraction Procedure (EP) toxicity test
    - The EPA Toxic Characteristic Leaching Procedure (TCLP) toxicity test
    - SW-924 (Deionized Water Extraction test method)
- To analyze the laboratory-produced leachates for
    - Inorganics
    - Semi-volatile compounds
    - Homologs of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans

- To analyze the ashes and the leachates collected from the codisposal facilities for homologs of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs).

- To compare analytical chemical results obtained for the collected leachate samples from the codisposal sites to those obtained for the laboratory-produced leachates.

- To compare the analytical chemical results obtained from the collected leachate samples as well as the laboratory-produced leachate samples, to results obtained for leachate collected from hazardous waste sites.

1.3 APPROACH TO STUDY

Since this study was one of a series of studies sponsored by EPA for the same ultimate goal, it was decided to utilize, as much as possible, sampling and analytical methodologies employed by other contractors in the course of the other studies. The main study, which had been in progress when this study started, was the Versar study entitled Characterization of Municipal Waste Combustor Residues, April 24, 1987. To maintain continuity and to allow for comparisons to be made, the decision was made to

- Send ashes to be leached by Versar.

- Have Versar conduct inorganic and semivolatile analyses on ashes and laboratory-produced leachates.

- Send leachates and ashes collected from the codisposal sites and Versar laboratory-produced extracts to Battelle, Columbus, for PCDD and PCDF analyses.

A thorough search was conducted for a laboratory to conduct the RCRA Appendix IX analyses (see complete listing in Tables 2-1 and 2-2 in Appendix F of this report). Since this newly compiled listing of hazardous substances had not undergone many practical applications, it was decided to use the S-Cubed laboratory, which conducted significant method development work on this list for

EPA and which had an EPA-approved quality assurance/quality control (QA/QC) program.

Care was placed in selecting suitable sites to represent, as much as possible, naturally occurring leaching conditions from municipal disposal sites and codisposal sites.

The sampling data used in this study originated from four facilities, none of which accepted hazardous waste. All four facilities went into operation after RCRA was promulgated and are believed to be in accordance with RCRA requirements. For this reason, these data are by no means representative of the solid waste industry in general.

The approach to the study is summarized in the NUS Work Plan submitted and approved by EPA. This Work Plan is provided in Appendix A.

2.0 SITE SELECTION

The objective of the site selection was to identify four professionally managed municipal waste disposal sites and two codisposal sites for the purpose of leachate sampling and analysis. The three major steps in the site selection process were

- Identification of a Master List of Operating Landfills. Locating landfills throughout the United States that accept either municipal waste or a combination of municipal waste and MWC residues (codisposal sites).

- Preliminary Screening of Candidates. Screening of located landfills based on conformance to site-specific criteria; e.g., the existence of a leachate collection system, site age, and the availability of waste-type information.

- Final Site Selection. Selecting candidate landfills based on willingness to participate, site location, waste type, and USEPA approval.

2.1 IDENTIFICATION OF MASTER LIST OF OPERATING FACILITIES

EPA provided NUS with a computerized list of 116 operating landfills in 8 states. The number of facilities per state was as follows:

Arkansas - 21
Colorado - 15
Connecticut - 8
Delaware - 3
Florida - 18
Oregon - 17
Texas - 20
Wisconsin - 14

This list, which was compiled from answers to a questionnaire, contained pertinent information regarding the site location, operating conditions, engineering information, and data related to wastes disposed of on site. Since the data were obtained from individuals of different technical backgrounds, the information had to be verified prior to use.

Very few codisposal sites were identified, and the information supplied about them was often incorrect. For example, a site that was identified on the master list as a codisposal site, in reality accepted coal-ashes rather than MWC ashes.

2.2 PRELIMINARY SCREENING OF CANDIDATE SITES

The second step of the site selection process was screening of candidate sites on the basis of their conformance to certain site-specific criteria. These criteria are listed below, in decreasing order of importance, and are discussed in the paragraphs that follow:

- Existence of a leachate collection system
- Accessibility of the site for leachate sampling
- Availability of a "Case Study" for the site
- Age of the site: The site should have been constructed after the enactment of RCRA regulations.
- Accessibility of information on waste input: These site should not accept industrial wastes.
- Geographic and climatic location of the site

The first of the five criteria, the existence of a leachate collection system, was mandatory in the site selection process. A site was eliminated from further consideration if it did not have an operating leachate collection system. Samples could be expeditiously collected only at sites with operating leachate collection systems.

The second criterion, accessibility of the site for leachate sampling, included two factors: (1) the willingness of the facility to cooperate with the contractor; and (2) the physical ease with which leachate could be sampled from the collection system. Potential sites that satisfied this criterion were ranked more positively than those sites where leachate collection appeared to be more difficult and time consuming.

The third criterion, availability of "Case Studies," was important because these EPA-generated documents contain extremely important information of studied disposal sites. These "Case Studies" were generated by EPA contractors and all have an identical outline, which includes information regarding waste characteristics, design characteristics, operation and management practices, and environmental impacts (monitoring and damage assessment) as well as cost data. EPA provided NUS with the studies for the selected sites.

None of the codisposal sites were included in the "Case Study" lists.

The age of a site, the fourth criterion, is important because age affects leachate generation rates and is a good indicator of environmental design features. A site in operation for less than 5 years may not generate sufficient leachate for sampling, and the generated leachate may not be representative of all the disposed wastes at the site. For these reasons, a minimum age of 5 years was originally designated for site screening. However, many sites or cells with leachate collection systems had operated for less than 5 years. Therefore, screening emphasis was instead placed on whether or not the site's leachate volume was sufficient for sampling. The sites were to have been constructed after RCRA Regulations came into effect.

The fifth significant site selection criterion was the availability of information regarding waste input. Adequate correlation of leachate quality to specific waste types is critical in designing containment systems; thus, reliable information regarding the types and quantities of disposed wastes was necessary. The sites selected should not accept industrial wastes.

The sixth significant criterion in the site selection process was site location and associated climate. Precipitation and evaporation rates affect leachate generation rates; thus climate must be considered in the design of liner containment systems for hazardous waste facilities. Climate of a site was characterized during this process, based on an area's net precipitation. Net precipitation indicates the potential for leachate generation rates at a site, and is calculated for a region by subtracting the average annual lake evaporation from the mean annual precipitation.

An original objective of the site screening process was to select sites in areas with varying climatic conditions, and thereby create a representative spectrum of existing site conditions. However, optimum diversity in climate was difficult to achieve while still satisfying the more important criteria discussed above. Therefore, during the final selection stage, emphasis was also placed on selection of sites located in diverse geographic locations, while still maximizing climatic diversity to the extent possible.

On the basis of conformance with the the first screening consideration, the availability of a leachate collection system, 44 candidate sites were selected from the original master list of 116 for further evaluation. Based on the additional five criteria, the 44-site list was reduced to 25 sites.

2.3 FINAL SITE SELECTION

2.3.1 Final Selection of Municipal Disposal Sites

The applicable state agencies were contacted to verify the information available in the Master List for the final list of 25 sites. Following the state contacts, the individual site operating managers or engineers were contacted with requests for information, for permission to conduct the study, and for storage space for containers and in-situ monitoring instruments.

As a result of these contacts four sites were selected, which for confidentiality purposes are coded as follows

- PC
- FL
- SM
- VD

For these four sites, "Case Studies" were prepared. They are provided, with slight modifications which were made for confidentiality reasons, in Appendix B.

Table 2-1 provides a summary of the characteristics of the selected Municipal Solid Waste disposal sites.

TABLE 2-1

CHARACTERISTICS OF SELECTED MUNICIPAL SOLID WASTE DISPOSAL SITES

Facility	Opened for Operation	Capacity (yards³/year)	Geographic Profile	Waste Characteristics	Method of Placement	Liner	Leachate Collection/ Treatment System	Cover
PC	1983 Closure ~1998	80,000	18.6 acres in rolling hills; areas range from rural agricultural to residential; soil is glacial and moraine, mostly highly permeable sandy till.	Garbage Refuse Wood matter Demolition debris	Area-Fill	5-foot-thick clay (permeability 7×10^{-3} to 4×10^{-2} cm/sec)	6-inch perforated PVC pipes in gravel trenches, hauled to POTW.	Daily - 6 inches of soil. Final - 2 feet of compacted clay soil and 6 inches of topsoil
FL	May 1975 Closure ~1992	23,000	120-acre site in forested area; soils are medium- to fine-grained sands, underlain by silty to clay-like sand.	Garbage Construction debris Yard trash Tomato waste Wood scrap	Sequential trench method	6-inch-thick bentonite polymer and soil (permeability 1×10^{-7} cm/sec)	6-inch perforated PVC pipes in gravel trenches, pumped to sealed pool, evaporated and hauled to POTW.	Daily - 6 inches of soil. Final - 18 inches of bentonite soil mix
SM	1976	1.5×10^6	58 acres in floodplain and adjacent uplands; agricultural area soil consists of clay, mudstone, sandstone, and volcanic rocks	Municipal waste Municipal sewage sludge	Trench and area fill	None - naturally lined with clay and mudstone	Collected in trenches, pumped to lagoon, stored in winter, spray irrigated on adjacent land in summer.	Daily - 6 inches of soil. Final - 2 feet of clay topsoil.
VD	January 1980	480,000 (75 tons/day)	100 acres in a large drainage ravine; ground is shale covered with slope-wash soils and residual soils (clay and shale)	Municipal Waste Construction Debris Dead Animals Sludge	Ramp Method	None	Collection reservoir on downgradient side of fill; leachate is sprayed back over landfill area.	Daily - 6 inches of weathered shale Final - 2 feet of compacted topsoil

2.3.2 Final Selection of Codisposal Sites

Of the 44 candidate sites identified in the initial screening process, none were suitable to qualify as codisposal sites. In addition to the criteria provided for the MSW sites, an additional important criteria was added for the codisposal sites: The MWC ash fraction of the entire MSW was to be at least 25 percent of the total volume. This information was obtained through telephone conversations with the appropriate state agencies.

As a result, a new site selection process was initiated to identify two codisposal sites. State agencies were contacted to identify sites that fit the criteria described in Section 2.2. Sites identified by state agencies were individually contacted to verify the existence of a leachate collection system, accessibility for leachate sampling, etc. As a result of this effort, two sites were selected. These sites are coded, as follows, for confidentiality purposes.

- NY
- NC

There are no "Case Studies" for these two codisposal sites. The information obtained regarding these sites is given in the trip report generated by the sampling crews who visited the sites and who are also project team members. The trip report is attached as Appendix C.

Table 2-2 provides a summary of the characteristics of the selected codisposal sites.

2.3.3 Interaction with Site Operators

Following the site selection process, EPA issued individual letters to each site manager with information about the purpose and nature of the study. NUS contacted the sites to schedule the sampling trips.

Cooperation from every site was extremely good. Equipment and chemical preservatives, which had to be shipped to sites prior to the crew arrival, were obtained by site personnel. Site personnel also accompanied the sampling crew to the leachate collection and sampling points and were helpful in every possible way.

TABLE 2-2

CHARACTERISTICS OF SELECTED CODISPOSAL (MSW AND MWC ASH) SITES

Facility	Opened for Operation	Geographic Profile	Capacity (yards^3/year)	Waste Characteristics	Liner	Leachate Collection/ Treatment System	Cover
NY	April 1985	Not available	4 x 10^4 tons/year ash and refuse and 8,000 yards^3/year sludge and ash	Ash Hardfill (i.e., metal scrap) Sewage sludge Sewage sludge ash Humane society wastes	Two clay liners	Collection system between two liners, pumped to holding tanks and then to POTW.	None
NC	November 1981	Not available	Not available	MWC ash Calcium nitrite Glass sludge Dimethyltriphthalate MSW (MSW:ASH = 3:1)	3-foot, sand, high-density liner 2-foot, sand, 20-mil PCV liner	Collection system above liners, pumped to lined lagoon, then to POTW.	MWC ash is used as a daily cover.

3.0 QUALITY ASSURANCE AND QUALITY CONTROL PROGRAM

NUS and the subcontracted analyzing laboratories adhered to stringent quality assurance and quality control (QA/QC) practices for the sampling and the analytical efforts. Because sampling and analytical procedures were already approved by EPA for similar projects, a site-specific Quality Assurance Program Plan (QAPP) was not deemed necessary.

3.1 SAMPLING PROCEDURES

Although the sites NUS sampled are not hazardous, NUS adhered to the NUS Operating Guidelines Manual for CERCLA activities at CERCLA sites, which NUS prepared for the EPA. The document was thoroughly reviewed and accepted by EPA for work performed on hazardous waste sites under the Superfund Program. The document was initially prepared in 1981 and has been updated annually since. It has served as a QA/QC document for many subcontractors conducting work for EPA on similar sites. Section 4.2.9 of this document, Sampling, is applicable for the work conducted for this study and is provided as Appendix D.

Three repetitive samples were taken from each of the six sites sampled. In addition to these 18 samples, one field blank and one duplicate sample were added by the sampling team for QC purposes. Other QC samples were incorporated by the individual laboratories performing the specific analyses, as further described below.

3.2 HEALTH AND SAFETY PROCEDURES

Prior to initiating the field trips, a site-specific health and safety plan was prepared for each individual site by a qualified and experienced NUS health and safety specialist. This Health and Safety Plan is given in Appendix E. Samplers were briefed by the health and safety specialist regarding precautions that should be taken prior to, during, and after sampling. Samplers were equipped with needed equipment (e.g, breathing apparatus) in case sampling had to be done inside manholes or in other unventilated areas.

NUS personnel who conducted the sampling on this project have had 40 hours of Occupational Safety and Health Administration (OSHA) and CERCLA health and safety training, and first-hand experience collecting similar samples at many other solid and hazardous waste sites.

3.3 CONVENTIONAL ANALYSES - NUS PITTSBURGH LABORATORY

The NUS laboratory in Pittsburgh conducted the conventional analyses, including tests for nitrate, ammonia, alkalinity, chemical oxygen demand (COD), etc., on the collected leachate samples. This laboratory adhered to the QA/QC procedures required by the individual methods employed. The methods employed followed procedures listed in 16th Edition of Standard Methods for the Examination of Waste and Wastewater. In addition, NUS adhered to the requirements listed in the NUS Procedures Manual for the Laboratory Services Division as issued in October 20, 1986.

The results are summarized in Section 4.0. The field blank was not contaminated with respect to any of the parameters of interest. There was good agreement (low Relative Percent Differences [RPDs]) between the results for the field duplicate samples.

3.4 RCRA APPENDIX IX ANALYSES - S-CUBED LABORATORY

Collected leachate samples were analyzed for RCRA Appendix IX analyses by the S-Cubed Laboratory. This laboratory was selected for this task because it participated in method development work for Appendix IX analyses for EPA and because its QA/QC program was acceptable to EPA. Essentially, S-Cubed was asked by NUS to adhere to the Contract Laboratory Program - Hazardous Substance List (CLP-HSL) QA/QC program.

Metals by atomic absorbtion (AA) and miscellaneous inorganics, purgeable and extractable organics by gas chromatography/mass spectrometry (GS/MS), and pesticides by GC were incorporated in the S-Cubed analytical effort (Appendix F). QA objectives were defined as CLP QC limits for all organic and inorganic analyses. A field blank, duplicate, matrix spike, and matrix spike duplicate were analyzed to assess analytical precision and accuracy. Additionally, all samples for organic analysis incorporated specific surrogates for an additional assessment of accuracy.

Results of the field blank analyses revealed only sodium and methylene chloride as contaminants. Results of the duplicate sample analytes indicated a good analytical reproducibility (low RPDs) for essentially all analytes at concentrations significantly above detection limits.

Recoveries of matrix-spiked organic compounds and surrogates were generally within CLP QC limits. Recoveries of matrix-spike metal analytes were generally within the reasonable range of 80-131 percent. Recoveries outside this range were largely attributable to spike concentrations of less than the sample concentrations and spiked concentrations approaching accurate quantification limits.

The list of analyses conducted by S-Cubed on this project, the obtained results, and QA/QC results are given in Appendix F. Since this project was one of the first to attempt to provide analytical results for the entire Appendix IX list, several difficulties in providing analyses for several compounds resulted. These are discussed on pages 24 and 25 of Appendix F.

3.5 ASH ANALYSES AND LEACHATE GENERATION TESTS - VERSAR

Versar prepared a comprehensive and extensive Quality Assurance Project Plan (QAPP) for its project regarding monofills. This Quality Assurance Project Plan was reviewed and approved by the EPA Office of Research and Development, Hazardous Waste Engineering Research Laboratory (HWERL). Versar was asked by NUS to adhere precisely to those portions of the QAPP which applied to this project.

The two ash samples collected from the codisposal sites were leached according to the EP, TCLP, and SW-924 procedures, followed by analysis of the leachates for metals by inductivily coupled plasma (ICP) and extractable organics (HSL target compounds) by GC/MS. The complete Versar analytical report is incorporated as Appendices G (metals) and H (organics). Duplicate and matrix-spiked samples were run with respect to one of the ash-sample analyses to assess precision and accuracy. QA objectives for precision and accuracy were defined as an RPD of 20 percent and recoveries of 80-120 percent for metals, and CLP QC limits for organics.

QC results for the metals analyses were comprehensively reported, these results consistently met QA objectives for both precision and accuracy. In those isolated cases in which QA objectives were not met, a reasonable and adequate narrative explanation was provided. No extractable organics corresponding to HSL target compounds (except benzoic acid) or PCBs were detected in the leachates.

Appendix G and Appendix H contain the inorganic and organic results as well as the QA/QC information as pertained to the analyses reported in these Appendixes.

3.6 PCDD AND PCDF ANALYSES - BATTELLE, COLUMBUS

The Battelle, Columbus laboratory prepared Appendix A of the Versar QAPP, which applies to the PCDD and PCDF Analysis for this project. As mentioned in Section 3.5, this QAPP, including the Battelle PCDD and PCDF analytical portion, was reviewed and approved by the HWERL. Appendix I of this report contains the PCDD and PCDF results and the QA/QC protocols.

Battelle, Columbus laboratories performed the PCDD/PCDF analysis by high resolution GC and high resolution/MS on two ash samples from the codisposal sites and associated leachates (Appendix I). A method blank was processed in association with each sample, and two matrix (native) spikes were processed, one for the ash matrix and one for the leachate matrix.

Recoveries of nine internal standards were consistently in the 90-110 percent range. The narrative of Appendix I indicates that recovery of spiked PCDD/PCDF standards was in the 80-130 percent range.

4.0 ANALYTICAL RESULTS OF COLLECTED LEACHATES

Chemical analytical results obtained in the course of this study from the four selected municipal disposal sites and the two selected codisposal sites are reported in this section.

4.1 CONVENTIONAL RESULTS

Three samples were collected at each of the six sites visited. In addition, one field blank at the VD site (VD-LE-000), one duplicate sample at the PC site (PC-LE-003A), and one rainwater runoff sample (from offsite area near entry to the disposal site) from the SM Site (SM-LE-004) were analyzed in-situ for Eh, pH, specific conductance, and temperature. These 21 samples were sent to the NUS Pittsburgh laboratory to be analyzed for the following conventional parameters: alkalinity, organic carbon, chemical oxygen demand (COD), chloride, hardness, sulfate, phosphate, total nitrogen, total dissolved solids (TDS), and suspended solids (SS). Nineteen of these twenty one samples were leachate samples.

Results of the in-situ measurements as well as the conventional parameters are reported in Table 4-1. Sampling procedures, sampling locations, preservation methods, and shipping procedures are provided in detail in the NUS trip report, Appendix C. Table 4-2 summarizes the ranges of these constituents within the 21 samples.

Examination of the data reported in Table 4-1 indicates the following:

- The field blank (VD-LE-000) was essentially pollutant free. This sample's pH was 9.45. Although it appears to be too basic for a blank sample, the laboratory deionized water obtained through ion exchange columns is often of this pH. The sample was checked several times in the laboratory and in the field.

- The rainwater runoff sample was relatively clean, with a pH of 7.05, total dissolved solids (TDS) value of 180 ppm, and a total hardness value of

TABLE 4-1

IN-SITU AND CONVENTIONAL PARAMETER ANALYSES OF COLLECTED LEACHATE SAMPLES IN mg/l (ppm) OR AS INDICATED

Inorganics	PC-LE-001	PC-LE-002	PC-LE-003	PC-LE-003A	SM-LE-001	SM-LE-002	SM-LE-003	SM-LE-004 (Rainwater Runoff)
Alkalinity, Total ($CaCO_3$)	4,200	4,000	3,800	3,800	1,700	1,700	1,700	110
Ammonia as N (distillation)	330	350	320	330	230	230	220	<0.1
Organic Carbon (non-purgeable)	2,510	2,680	2,400	2,480	259	237	245	7.7
COD (O_2)	8,500	8,700	8,600	8,700	1,000	1,200	1,200	23
Chloride (Cl)	820	820	780	760	680	660	660	23
Hardness, Total Macro ($CaCO_3$)	2,900	3,000	2,800	2,900	720	670	690	100
Nitrate (N)	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite (N)	0.05	<0.04	0.05	<0.04	<0.04	<0.04	<0.04	<0.04
Nitrogen, Kieldahl (N)	380	390	380	370	270	280	280	0.7
Nitrogen, Organic (N)	50	40	60	40	40	50	60	0.7
Phosphorus, Total (P)	1.5	2.0	1.3	0.53	3.8	2.1	2.3	13
Solids, Dissolved at 180° C	7,020	31,800	7,720	7,720	2,730	2,710	2,760	180
Solids, Suspended at 103° C	616	672	928	508	44	32	76	26
Sulfate, Turbidimetric (USA)	<20	<20	<20	<20	<20	<4	<4	<4
Field Parameters								
pH, pH units	7.25				7.8			7.05
Eh (Millivolts)	-481 millivolts				-486 millivolts			-78 millivolts
Specific Conductivity (μmhos/cm)	8,800 μmhos/cm				300 μmhos/cm			270 μmhos/cm
Temperature	11.3°C				18.0°C			18.1°C

TABLE 4-1
IN-SITU AND CONVENTIONAL PARAMETER ANALYSES OF COLLECTED LEACHATE SAMPLES IN mg/l (ppm) OR AS INDICATED
PAGE TWO

Inorganics	VD-LE-001	VD-LE-002	VD-LE-003	VD-LE-000 (Field Blank)	FL-LE-01	FL-LE-02	FL-LE-03
Alkalinity, Total ($CaCO_3$)	1,700	1,700	1,600	7	4,100	4,700	4,700
Ammonia as N (distillation)	53	70	79	0.2	580	560	550
Organic Carbon (non-purgeable)	138	148	140	<1.0	1,000	923	810
COD (O_2)	470	520	690	9	2,400	2,400	2,400
Chloride (Cl)	570	580	570	<1	1,600	1,600	1,600
Hardness, Total Macro ($CaCO_3$)	1,300	1,300	1,300	2	1,000	1,100	1,000
Nitrate (N)	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
Nitrite (N)	<0.04	<0.04	<0.04	<0.01	<0.04	<0.04	<0.04
Nitrogen, Kieldahl (N)	73	110	99	12	660	660	650
Nitrogen, Organic (N)	20	40	20	12	80	100	100
Phosphorus, Total (P)	0.3	0.2	0.3	<0.02	12	12	11
Solids, Dissolved at 180° C	3,130	3,110	3,090	7	4,260	6,180	5,860
Solids, Suspended at 103° C	94	82	88	0	166	160	184
Sulfate, Turbidimetric (USA)	420	390	420	<1	<4	220	<4
Field Parameters							
pH, pH units	6.98			9.45	7.05		
Eh (Millivolts)	-411 millivolts			-146 millivolts	-804 millivolts		
Specific Conductivity (µmhos/cm)	3,900 µmhos/cm			20	>10,000 µmhos/cm		
Temperature	9.6° C			15.0° C	25° C		

TABLE 4-1

IN-SITU AND CONVENTIONAL PARAMETER ANALYSES OF COLLECTED LEACHATE SAMPLES IN mg/l (ppm) OR AS INDICATED

PAGE THREE

Inorganics	NY-LE-01	NY-LE-02	NY-LE-03	NC-LE-01	NC-LE-02	NC-LE-03
Alkalinity, Total ($CaCO_3$)	1,800	1,800	1,800	3,600	3,900	3,600
Ammonia as N (distillation)	160	170	190	380	410	380
Organic Carbon (non-purgeable)	1,250	1,270	1,310	461	438	448
COD (O_2)	3,800	3,300	3,900	1,400	1,900	1,300
Chloride (Cl)	2,100	2,100	2,100	1,200	1,300	1,300
Hardness, Total Macro ($CaCO_3$)	2,200	2,200	2,100	900	930	900
Nitrate (N)	0.7	0.5	0.6	<0.1	<0.1	<0.1
Nitrite (N)	<0.04	<0.04	<0.04	<0.05	<0.05	<0.05
Nitrogen, Kieldahl (N)	190	210	250	410	420	450
Nitrogen, Organic (N)	30	40	60	70	10	70
Phosphorus, Total (P)	1.1	0.97	0.97	1.7	2.3	1.5
Solids, Dissolved at 180° C	1,940	1,930	7,970	4,880	5,130	5,040
Solids, Suspended at 103° C	45	54	251	184	2,220	108
Sulfate, Turbidimetric (USA)	<20	<20	<20	56	42	57
Field Parameters						
pH, pH units	7.2			7.3		
Eh (Millivolts)	-383 millivolts			-541 millivolts		
Specific Conductivity (μmhos/cm)	> 10,000 μmhos/cm			8,400 μmhos/cm		
Temperature	5.0° C			21.1° C		

TABLE 4-2

RANGES OF IN-SITU AND CONVENTIONAL PARAMETER CONCENTRATIONS IN COLLECTED LEACHATE SAMPLES IN mg/l (ppm) OR AS INDICATED

Constituent	Range
Inorganics	
Alkalinity, Total ($CaCO_3$)	1,600 - 4,700
Ammonia as N (distillation)	53 - 580
Organic Carbon (non-purgeable)	138 - 2,680
COD (O_2)	470 - 8,700
Chloride (Cl)	570 - 2,100
Hardness, Total Macro ($CaCO_3$)	670 - 3,000
Nitrate (N)	<0.1 - 0.7
Nitrite (N)	<0.04 - 0.05
Nitrogen, Kieldahl (N)	73 - 660
Nitrogen, Organic (N)	10 - 100
Phosphorus, total (P)	0.2 - 12
Solids, Dissolved at 180° C	1,930 - 31,800
Solids, Suspended at 103° C	32 - 2,220
Sulfate, Turbidimetric (USA)	<4 - 420
Field Parameters	
pH, pH units	6.98 - 7.8
EH (Millivolts)	-383 millivolts - -804 millivolts
Specific Conductivity (µmhos/cm)	300 (µmhos/cm) - 8,800(µmhos/cm)
Temperature	5.0°C - 25°C

Note:

No. of Sites: 6
No. of Samples: 19
(3 per site + one duplicate)

100 parts per million (ppm) (as $CaCO_3$). The phosphorus value of this runoff sample was about five times the average of the leachates. This fact indicates that the phosphorus may be introduced into the landfill from the local soils rather than from the contents of the landfill.

- There was extremely good agreement between the two field duplicate samples (PC-LE-003) and PC-LE-003A). Relative Percent Differences (RPD) between these two samples were very close, except for phosphorus (P), which had values of 1.3 and 0.53 ppm, and suspended solids, with values of 928 and 508 ppm. The higher suspended solids values could have contained somewhat higher phosphorus levels. The good agreement between the duplicate samples indicates sample representativeness, proper sampling procedures, and analytical reproducibility.

- Each of the three samples collected at each individual landfill was very close in value to the other two samples. The only exceptions occurred in TDS (PC-LE-002 and NY-LE-03), suspended solid values (NY-LE-03 and NC-LE-02), and sulfate (FL-LE-02). These data indicate the limitations of representativeness provided by the "grab" sampling method.

- With respect to the conventional parameters, variations of leachate quality were apparent between the different landfills.

- There was no apparent difference in leachate characteristics (as expressed by the conventional parameter analyses) between the municipal disposal sites and the codisposal sites. The NY codisposal landfill appeared relatively the "cleanest" of the six sites, whereas the NC codisposal landfill was of similar quality to the rest of the other landfills. The VD municipal landfill appeared the "cleanest" of the municipal landfills.

- The higher range values of the conventional parameters, listed in Table 4-2, did not originate from the codisposal sites, except for the following: all three chloride values from the NY site, one chloride value from the NY site, and one suspended solid value from the NC site.

4.2 INORGANIC RESULTS

Table 4-3 lists the inorganic content of leachates collected from the six selected sites, and Table 4-4 presents a summary of ranges for these elements. Three samples were collected from each sit. In addition, one field blank (VD-LE-000) and one duplicate sample (PC-OE-003 and PC-LE-003A), as described in Section 4.1 and in Appendix C, the trip report, were sent to the S-Cubed laboratory to be analyzed for the inorganic parameters included in RCRA Appendix IX. Full results are provided in Appendix F of this report.

Data presented in Tables 4-3 and 4-4 indicate the following:

- The field blank was virtually clean of inorganic contaminants. It contained only 118 mg/l of sodium and 0.08 mg/l of zinc.

- The two duplicate samples, PC-LE-003 and PC-LE-003A, were very close in composition. RPD values for measurements greater than 10 times the detection limts were less than 15 percent, except for potassium, which was 26 percent.

- Generally, the three samples collected from each individual landfill were very close in inorganic (metal) content.

- Similarly to the conventional parameter results, the inorganic content varied from site to site. Leachates from one site were higher in one element while those from another were higher in another element.

- All leachate samples were well below the EP toxicity maximum allowable limit for metals. The spike recoveries of chromium, lead, silver, and selenium were relatively low (ranging between 36 and 41 percent), a fact which could suggest that the actual concentrations of these elements in these leachate samples might be higher. These concentrations, however, were significantly lower than the EP toxicity maximum allowable limits.

TABLE 4-3

APPENDIX IX INORGANIC CONSTITUENTS IN LEACHATES COLLECTED FROM MUNICIPAL AND CODISPOSAL SITES IN mg/l (ppm) OR AS INDICATED

Parameter	FL-LE-01	FL-LE-02	FL-03	SM-LE-001	SM-LE-002	SM-LE-003
Aluminum	5.4	5.8	5.0	—	—	1.6
Antimony	—	—	—	—	—	—
Arsenic	0.023	0.019	0.023	0.01	0.009	0.009
Barium	0.48	0.48	0.34	0.41	0.34	0.34
Beryllium	—	—	—	—	—	—
Cadmium	0.006	0.005	0.007	0.002	0.003	0.002
Calcium	352	343	319	150	174	146
Chromium	0.012	0.012	0.010	0.006	0.005	0.009
Cobalt	—	—	—	—	—	—
Copper	—	—	—	—	—	—
Iron	16.3	17.6	16.4	6.4	6.5	6.6
Lead	0.053	0.035	0.061	0.009	0.015	0.006
Magnesium	125	117	116	75	74	77
Manganese	1.31	1.34	1.30	1.68	1.67	1.68
Mercury	—	—	—	—	—	—
Nickel	—	—	—	0.13	0.13	0.13
Potassium	871.1	744.0	816.6	217.8	228.7	199.6
Selenium	0.006	0.006	—	—	—	—
Silver	—	—	—	—	—	—
Sodium	1,293	1,228	1,510	576.0	781.7	1,334
Thallium	—	—	—	—	—	—
Tin	—	—	—	—	—	—
Vanadium	0.009	0.011	0.021	0.023	0.024	0.020
Zinc	2.32	2.59	2.39	0.24	0.30	0.28
Osmium	—	—	—	—	—	—
pH, (pH Units)	7.05			7.8		
Specific Conductivity (µmhos/cm)	>10,000			300		
Temperature (°C)	25			18		
EH (Millivolts)	-804			-486		

TABLE 4-3
APPENDIX IX INORGANIC CONSTITUENTS IN LEACHATES COLLECTED FROM MUNICIPAL AND CODISPOSAL SITES
IN mg/l (ppm) OR AS INDICATED
PAGE TWO

Parameter	VD-LE-000	VD-LE-003	VD-LE-001	VD-LE-002
Aluminum	—	—	—	—
Antimony	—	—	—	—
Arsenic	—	0.007	0.007	0.006
Barium	—	0.48	0.48	0.55
Beryllium	—	—	—	—
Cadmium	—	—	—	—
Calcium	—	258	272	263
Chromium	—	0.003	0.003	0.002
Cobalt	—	—	—	—
Copper	—	—	—	—
Iron	—	22.8	23.2	21.2
Lead	—	—	—	—
Magnesium	—	189	189	182
Manganese	—	0.31	0.30	0.27
Mercury	—	—	—	—
Nickel	—	0.16	—	0.14
Potassium	—	268.6	145.2	270.4
Selenium	—	—	—	—
Silver	—	—	—	—
Sodium	118.0	681.8	552.5	552.5
Thallium	—	—	—	—
Tin	—	—	—	—
Vanadium	—	0.014	0.013	0.011
Zinc	0.08	0.10	0.07	0.18
Osmium	—	—	—	—
pH (pH Units)			6.98	
Specific Conductivity (µmhos/cm)			3,900	
Temperature (°C)			9.6	
EH (Millivolts)	-146		-411	

TABLE 4-3
APPENDIX IX INORGANIC CONSTITUENTS IN LEACHATES COLLECTED FROM MUNICIPAL AND CODISPOSAL SITES
IN mg/l (ppm) OR AS INDICATED
PAGE THREE

Parameter	PC-LE-001	PC-LE-002	PC-LE-003	PC-LE-003A
Aluminum	2.4	3.4	2.8	2.2
Antimony	—	—	—	—
Arsenic	0.011	0.008	0.008	0.014
Barium	1.64	1.7	1.57	1.43
Beryllium	—	—	—	—
Cadmium	0.003	0.003	—	—
Calcium	709	657	794	747
Chromium	0.011	0.039	0.006	0.0065
Cobalt	—	—	—	—
Copper	—	—	—	—
Iron	268	261	242	214
Lead	—	0.048	0.012	—
Magnesium	424	422	412	400
Manganese	8.28	8.87	8.28	7.59
Mercury	—	—	—	—
Nickel	—	0.13	0.13	—
Potassium	453.7	471.8	471.8	363.0
Selenium	—	—	—	—
Silver	—	—	—	—
Sodium	817	822.8	846.3	752.3
Thallium	—	—	—	—
Tin	—	—	—	—
Vanadium	0.016	0.019	0.018	0.024
Zinc	0.44	0.51	0.38	0.33
Osmium	—	—	—	—
pH (pH Units)	7.25			
Specific Conductivity (µmhos/cm)	8,800			
Temperature (°C)	11.3			
EH (Millivolts)	-481			

TABLE 4-3
APPENDIX IX INORGANIC CONSTITUENTS IN LEACHATES COLLECTED FROM MUNICIPAL AND CODISPOSAL SITES
IN mg/l (ppm) OR AS INDICATED
PAGE FOUR

Parameters	NY-LE-01	NY-LE-02	NY-LE-03	NC-LE-01	NC-LE-02	NC-LE-03
Aluminum	—	—	—	—	—	—
Antimony	0.02	0.01	0.02	—	—	—
Arsenic	0.010	0.008	0.012	0.044	0.046	0.044
Barium	0.89	0.89	0.82	0.27	0.41	0.34
Beryllium	—	—	—	—	—	—
Cadmium	0.011	0.009	0.006	—	—	—
Calcium	775	765	803	216	207	174
Chromium	0.009	0.011	0.013	—	0.005	0.008
Cobalt	—	—	—	—	—	—
Copper	0.18	0.20	0.19	—	—	—
Iron	93.8	92.4	93.8	21.1	104	20.9
Lead	0.018	0.010	0.022	0.026	0.027	0.018
Magnesium	199	184	191	118	124	114
Manganese	11.3	11.2	11.3	1.31	1.48	1.29
Mercury	—	—	—	—	—	—
Nickel	0.23	0.23	0.24	0.13	0.14	—
Potassium	580.7	707.8	780.3	613.4	526.3	508.1
Selenium	—	—	—	—	—	—
Silver	—	—	—	—	—	—
Sodium	1,646	1,669	2,280	1,076	1,487	1,134
Thallium	—	—	—	—	—	—
Tin	—	—	—	—	—	—
Vanadium	0.015	0.015	—	0.017	0.029	0.024
Zinc	1.21	1.21	1.21	0.15	0.09	0.12
Osmium	—	—	—	—	—	—
pH (pH Units)	7.2			7.3		
Specific Conductivity (µmhos/cm)	>10,000			8,400		
Temperature (°C)	5			21.1		
EH (Millivolts)	-383			-541		

---- = Not detected above laboratory detection limit.

TABLE 4-4

RANGES FOR APPENDIX IX INORGANIC CONSTITUENTS IN LEACHATES COLLECTEDFROM MUNICIPAL AND CODISPOSAL SITES IN mg/l (ppm) OR AS INDICATED

Constituent	Range
Aluminum	1.6 - 5.8
Antimony	0.01 - 0.02
Arsenic	0.01 - 0.046
Barium	0.27 - 1.64
Beryllium	----
Cadmium	0.002 - 0.011
Calcium	146 - 803
Chromium	0.002 - 0.039
Cobalt	----
Copper	0.18 - 0.20
Iron	6.4 - 268
Lead	0.006 - 0.053
Magnesium	74 - 424
Manganese	0.27 - 11.3
Mercury	----
Nickel	0.13 - 0.24
Potassium	145.2 - 871.1
Selenium	0.006 - 0.006
Silver	----
Sodium	552.5 - 2,280
Thallium	----
Tin	----
Vanadium	0.009 - 0.029
Zinc	0.07 - 2.59
Osmium	----
pH (pH Units)	6.98 - 7.8
Specific Conductivity (µmhos/cm)	300 - 8,800
Temperature (°C)	5 - 25
EH (Millivolts)	-146 - -804

---- = Not detected above laboratory detection limit.

Note:

No. of Sites: 6
No. of Samples: 19
(3 per site + one duplicate)

- The higher range values listed in Table 4-4 did not originate from the codisposal sites, except for one arsenic value, one cadmium value, one calcium value, one copper value, one manganese value, one nickel value, one sodium value, and one vanadium value.

4.3 ORGANIC RESULTS

Table 4-5 summarizes the results obtained when analyzing the leachate samples collected at the six sites (including one field blank and one duplicate sample, as described in Section 4.1) for the organic parameters listed in RCRA Appendix IX. Table 4-6 lists the ranges of these values. Detailed analytical data are given in Appendix F of this report.

Data provided in Tables 4-5 and 4-6 indicate the following:

- The field blank was free of organic contaminants, except for methylene chloride.

- Results of the duplicate samples were close. All RPD values were within 20 percent except for methylene chloride and 4-methyl 2-pentanone, which were 119 and 57 percent respectively. All contaminants detected in one sample were also detected in the duplicate sample.

- Leachates from these sites contain a variety of volatile compounds: Acetone and methylene chloride were detected at every site; 2-butanone was detected in five sites. 2-Hexanone was present in four of the six sites; 4-methyl-2 pentanone was present in three sites; toluene in four, and ethylbenzene, xylenes, 1,1-dichloroethane, 1,2-dichloroethane, and 1,1,1-trichloropropane each were found in only one site.

- Acetone, methylene chloride, 2-butanone, and toluene were the most prevalent of the detected volatiles, and toluene was detected at the highest detected concentration--1.1 ppm. All of these compounds are common solvents, which makes their use universal, including their use as laboratory solvents.

TABLE 4-5

ORGANIC CONCENTRATIONS IN LEACHATES FROM MUNICIPAL AND CODISPOSAL SITES IN mg/l (ppm), OR AS INDICATED

	FL-LE-01	FL-LE-02	FL-LE-03	SM-LE-001	SM-LE-002	SM-LE-003
VOLATILES						
Acetone	4.6	3.8	1.9	0.17	0.35	0.29
2-Butanone	1.5	1.3	3.0	0.29	0.43	0.44
Methylene chloride	0.06J	0.11	0.04J	0.002J	0.003J	0.003J
2-Hexanone	0.4	0.039	0.085J	0.006J		0.012
4-Methyl-2-pentanone	0.29					
Toluene	1	1.1				
Ethylbenzene						
Total xylenes						
1,1-Dichloroethane						
T-1,2-Dichloroethene						
1,1,3-Trichloropropane						
ACID EXTRACTABLES						
P-cresol (4-methyl phenol)				0.054	0.053	0.078
Phenol				0.041	0.045	0.078
BASE/NEUTRAL EXTRACTABLES						
Diethyl phthalate	0.032					
Bis (2-ethylhexyl) phthalate	0.017B	0.019B				
PESTICIDES, µg/l (ppb)						
4,4-DDT	0.14	0.16	0.22	0.11	0.056J	0.042J
2,4-D				120	89	
Lindane						
Endrin						
Endosulfan sulfate						

TABLE 4-5
ORGANIC CONCENTRATIONS IN LEACHATES FROM MUNICIPAL AND CODISPOSAL SITES IN mg/l (ppm), OR AS INDICATED
PAGE TWO

	VD-LE-000	VD-LE-001	VD-LE-002	VD-LE-003	PC-LE-001	PC-LE-002	PC-LE-003	PC-LE-003A
VOLATILES								
Acetone			0.008J	0.004J	4.0	4.1	4.3	4.0
2-Butanone					9.9	11.0	12.0	10.0
Methylene chloride	0.007	0.12	0.14	0.006	0.31	0.32	0.092	0.36
2-Hexanone					0.69	0.41J	0.36	0.37
4-Methyl-2-pentanone					0.57		0.061	0.11
Toluene					0.54	0.55	0.61	0.59
Ethylbenzene								
Total xylenes								
1,1-Dichloroethane		0.004J						
T-1,2-Dichloroethene		0.016	0.006	0.012				
1,1,3-Trichloropropane					0.23J			
ACID EXTRACTABLES								
P-cresol (4-methyl phenol)					4.4	4.4	4.5	5.1
Phenol					1.4	1.7	1.8	2.1
BASE/NEUTRAL EXTRACTABLES								
Diethyl phthalate								
Bis(2-ethyl hexyl) phthalate								
PESTICIDES, µg/l (ppb)								
4,4-DDT					0.042J	0.05J	0.10	0.11
2,4-D								
Lindane							0.017J	0.023J
Endrin								
Endosulfan sulfate					0.28			

TABLE 4-5
ORGANIC CONCENTRATIONS IN LEACHATES FROM MUNICIPAL AND CODISPOSAL SITES IN mg/l (ppm), OR AS INDICATED
PAGE THREE

	NY-LE-01	NY-LE-02	NY-LE-03	NC-LE-01	NC-LE-02	NC-LE-03
VOLATILES						
Acetone	0.81	0.15		0.18	0.43	1.5
2-Butanone	2.2	1.6		0.12	0.73	1.1
Methylene chloride	0.098	0.17	0.19	0.29	0.039	0.038
2-Hexanone					0.088	0.45
4-Methyl-2-pentanone						0.08
Toluene	0.12	0.12		0.094	0.073	0.073
Ethylbenzene					0.015J	
Total xylenes					0.29	
1,1-Dichloroethane						
T-1,2-Dichloroethene						
1,1,3-Trichloropropane						
ACID EXTRACTABLES						
P-cresol (4-methyl phenol)	5.1			0.21		
Phenol	2.1			0.089	0.098	0.078
BASE/NEUTRAL EXTRACTABLES						
Diethyl phthalate						
Bis(2-ethyl hexyl) phthalate			0.17			
PESTICIDES, ug/l (ppb)						
4,4-DDT	0.053J	0.098J	0.099J	0.12	0.12	0.13
2,4-D	130		160			
Lindane						
Endrin	0.25					
Endosulfan sulfate						

B - Present in laboratory blank as well as sample.

J - Indicates estimated value. The presence of the compound was identified, but the result is less than the specified detection limit although greater than zero.

TABLE 4-6

RANGES OF ORGANIC CONCENTRATIONS IN LEACHATES FROM MUNICIPAL AND CODISPOSAL SITES IN mg/l (ppm), OR AS INDICATED

Constituent	Range
Acid Extractables	
P-cresol (4-methyl phenol)	0.053 - 5.1
Phenol	0.041 - 2.1
Volatiles	
Acetone	0.004J - 4.6
2-Butanone	0.12 - 12.0
Methylene chloride	0.002J - 0.36
2-hexanone	0.006J - 0.69
4-methyl-2-pentanone	0.061 - 0.57
Toluene	0.073 - 1.1
Ethylbenzene	--- - 0.015J
Total xylenes	--- - 0.29
1,1-dichloroethane	--- - 0.004J
T-1,2-dichloroethene	0.006 - 0.016
1,1,3-trichloropropane	--- - 0.23J
Base/Neutral Extractables	
Diethyl phthalate	--- - 0.032
Bis (2-ethyl-hexyl) Phthalate	0.017B - 0.17
Pesticides, µg/l (ppb)	
4,4-DDT	0.042J - 0.22
2,4-D	89 - 160
Lindane	0.017J - 0.023J
Endrin	--- - 0.25
Endosulfan-sulfate	--- - 0.28

J - Indicates estimated value. The presence of the compound was identified, but the result is less then the specified detection limit although greater than zero.
--- = Not detected above laboratory detection limit.
B - Present in laboratory blank as well as sample.
Note:
No. of Sites: 6
No. of Samples: 19
(3 samples per site + one duplicate)

- Comparison between the municipal and codisposal leachates indicates no clear difference. While leachates from one codisposal site were almost free of volatile compounds, leachates from the second site contained the highest frequency of volatile detections.

- 4-methyl phenol and phenol were the only two acid extractable compounds detected in leachates from any of these six sites; these two acid extractable compounds were detected in the leachates in the NY codisposal site.

- Leachates from two of the four municipal sites contained no acid extractables.

- Leachates from both codisposal sites contained both of the detected acid extractable compounds.

- The levels of phenol in the NY codisposal site leachates reached 2.1 ppm, and levels of 4-methyl phenol in the same site leachates reached 5.1 ppm.

- 32 ppb of diethyl phthalate was detected in only one leachate sample. This sample was from a municipal disposal site. Bis (2-ethyl-hexyl) phthalate was detected in one codisposal site.

- One or more pesticides were detected in every one of the sites except for the leachates from the VD site.

- The higher range values listed in Table 4-6 did not occur in the codisposal sites except for one ethyl benzene value and one xylene value, both only in one of the NC samples.

4.4 PCDD AND PCDF RESULTS

Leachates collected from the codisposal sites were sent to Battelle Columbus to be analyzed for polychlorinated dibenzo dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Results are listed in Appendix I of this report. This laboratory also analyzed ash samples collected from the same facilities as well as extracts generated by EP, TCLP, and deionized water (SW-924) leaching procedures for PCDDs and PCDFs. These results are also given in Appendix I.

Tables 4-7 and 4-8 summarize these data by site. Evaluation of data presented in these two tables indicates the following:

- 2,3,7,8-TCDD, the known most carcinogenic homolog, was not detected in the ashes, the leachates, or the extracts.

- The ashes contained ng/g (ppb) levels of total tetra, penta, hexa, hepta, and octa PCDDs and PCDFs.

- The NY ashes are a product of non-full combustion, the beginning of the burn (see trip report, Appendix C of this report). As a result, the concentrations of most homologs are somewhat higher in these ashes.

- No PCDD or PCDF homologs were detected in TCLP-produced extracts.

- SW-924 was run on only one ash sample. This leaching procedure produced only 0.035 ng/l (parts per trillion) of the octa dioxin homolog. According to the EPA "Toxicity Equivalency Factors" (TEF) by which the individual homolog toxicity is converted to 2,3,7,8-TCDD equivalency, the multiplying factor for this octa homolog is 0.00. In other words, the octa homolog toxicity is equivalent to 0.00 of the 2,3,7,8-TCDD toxicity.

- The EP toxicity leaching procedures produced, for one ash, 0.033 ng/l (parts per trillion) of the dioxin octa and, for the second ash, 0.031 ng/l (ppb) of the dioxin octa, and 0.021 ng/l (parts per trillion) of the dioxin hepta homologs. The TEF for H_PCDD is 0.001, which again means in reality no toxic equivalent value to 2,3,7,8-TCDD.

- The actual leachates collected at both codisposal sites contained very low concentrations of H_XCDD, H_PCDD, OCDD, PCDF, H_XCDF, H_PCDF, and OCDF.

TABLE 4-7

CHLORINATED DIOXIN AND CHLORINATED DIBENZOFURAN LEVELS IN ASH AND LEACHATES FROM THE NC CODISPOSAL LANDFILL

Compound	Ash in ng/g, (ppb)	Extracts in ng/l*			
		Field Leachate	TCLP	SW-924	EP-Tox
2,3,7,8-TCDD	-	-	-	-	-
Total TCDD	0.03	-	-	-	-
Total PCDD	0.10	-	-	-	-
Total H$_X$CDD	0.1	0.130	-	-	-
Total H$_P$CDD	0.18	0.770	-	-	0.021
Total OCDD	0.14	15	-	0.035	0.031
2,3,7,8-TCDF	0.07	-	-	-	-
Total TCDF	0.56	-	-	-	-
Total PCDF	0.29	0.035	-	-	-
Total H$_X$CDF	0.19	0.035	-	-	-
Total H$_P$CDF	0.11	0.085	-	-	0.012
Total OCDF	0.02	0.054	-	-	-

- Not detected
* Parts per trillion

TABLE 4-8

CHLORINATED DIOXIN AND CHLORINATED DIBENZOFURAN LEVELS IN ASH AND LEACHATES FROM THE NY CODISPOSAL LANDFILL

Compound	Ash in ng/g, (ppb)	Extracts in ng/l*		
		Field Leachates	TCLP	EP-Tox
2,3,7,8-TCDD	-	-	-	-
Total TCDD	0.02	-	-	-
Total PCDD	0.12	-	-	-
Total H_XCDD	0.43	0.047	-	-
Total H_PCDD	4.2	0.120	-	-
Total OCDD	9.9	0.210	-	0.033
2,3,7,8-TCDF	0.11	-	-	-
Total TCDF	0.46	-	-	-
Total PCDF	0.54	0.028	-	-
Total H_XCDF	1.2	0.041	-	-
Total H_PCDF	2.2	0.043		-
Total OCDF	1.7	0.023	-	-

- Not detected

* Parts per trillion

- The actual leachates from the two codisposal sites did not contain any tetra homologs, including 2,3,7,8.

- Although the ashes from one site exhibited higher concentrations of most homologs because of incomplete combustion, the leachate did not exhibit the same trend. The leachates reflect previously disposed ashes present at the site rather than the analyzed ashes.

- According to a recent Canadian Government publication, Ontario Ministry of the Environment: PCDDs and PCDFs, Scientific Criteria Document for Standard Development No. 4-84, Sept. 1985, dioxins and dibenzofurans were detected in actual solid waste found in municipal waste disposal sites. Such waste, the bulk of the codisposal site material, could contribute PCDDs and PCDFs to the leachates produced by these codisposal sites.

4.5 INORGANIC CONSTITUENTS IN LEACHATES AND EXTRACTS

Ashes collected from the two codisposal facilities were extracted by distilled water (SW-924), and by EP toxicity and TCLP leaching procedures. Samples were analyzed for inorganic constituents. Results are compared to the EP toxicity maximum allowable limit in Tables 4-9 and 4-10.

A review of the data presented in Tables 4-9 and 4-10 indicates the following:

- All EP toxicity maximum allowable limits were met except for lead. For the NY ash, the EP toxicity leachate was only 3.17 ppm. For the NC ash sample, the EP toxicity maximum allowable limits of 5 ppm was not met by any of the three leaching procedures, and in fact, exceeded it many folds. The levels were 49 ppm (EP); 240 ppm (TCLP), and 75 ppm (SW-924).

- Comparison of the severity of the leaching process between the EP and the TCLP procedures indicates that for one ash, the TCLP procedure leached consistently higher levels of metals, while for the second ash, the EP toxicity leaching procedure leached higher levels of cadmium and barium.

TABLE 4-9

INORGANIC CONTENT IN NY ASHES AND IN EP TOXICITY, TCLP, AND SW-924 EXTRACTS

Contaminant	Ash in mg/kg (ppm)	EP Toxicity in mg/l (ppm)	TCLP in mg/l (ppm)	SW-924 in mg/l (ppm)	EP Tox. Max. Allowable Limit (ppm)	Primary Drinking Water Standards in mg/l (ppm)
Arsenic	11.4	<0.02	0.203	Insufficient	5.0	0.050
Cadmium	14.8	0.195	0.155	Sample	1.0	0.010
Chromium	55.2	<0.02	0.270		5.0	0.050
Copper	226	-	-		-	-
Iron	18,900	-	-		-	-
Lead	630	3.17	9.58		5.0	0.050
Manganese	508	-	-		-	-
Mercury	0.10	<0.02	<0.002		0.2	0.002
Nickel	144	-	-		-	-
Selenium	<5	<0.05	<0.025		1.0	0.010
Zinc	1,510	-	-		-	-
Barium	-	0.832	0.633		100	1.000
Silver	-	<0.02	<0.02		5.0	0.050

TABLE 4-10

INORGANIC CONTENT IN NC ASHES AND IN EP TOXICITY, TCLP, AND SW-924 EXTRACTS

Contaminant	Ash in mg/kg (ppm)	EP Toxicity in mg/l (ppm)	TCLP in mg/l (ppm)	SW-924 in mg/l (ppm)	EP Tox. Max. Allowable Limit (ppm)	Primary Drinking Water Standards in mg/l (ppm)
Arsenic	19.6	0.049	0.169	0.026	5.0	0.050
Cadmium	8.6	0.275	0.384	<0.02	1.0	0.010
Chromium	28.2	0.043	<0.1	<0.02	5.0	0.050
Copper	5,100	-	-	-	-	-
Iron	11,900	-	-	-	-	-
Lead	3,240	48.8	240	75.4	5.0	0.050
Manganese	352	-	-	-	-	-
Mercury	3.8	<0.002	0.044	<0.002	0.2	0.002
Nickel	498	-	-	-	-	-
Selenium	<5	<0.05	<0.025	<0.005	1.0	0.010
Zinc	3,750	-	-	-	-	-
Barium	-	0.820	0.924	3.29	100.0	1.000
Silver	-	<0.02	<0.1	<0.02	5.0	0.050

5.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

In the course of this study, 13 samples of leachates from four municipal waste disposal sites and 6 leachate samples from two codisposal sites were analyzed for many conventional parameters to characterize the general water quality, as well as the entire Appendix IX list of compounds. These samples were not designed to represent samples from the entire industry but rather to report the situation at these six sites.

Sampling was selectively done at sites equipped with leachate collection systems and sites which were constructed post-RCRA and which do not accept industrial wastes for disposal. Sampling and analyses were carefully done while adhering to stringent QA/QC procedures.

The main findings of this study are as follows:

In-situ and Conventional Parameters

- The range of water-quality parameters detected in leachates collected in the 13 samples from the four municipal waste sites was similar to those reported in the literature for other sites, except for pH, BOD, COD and TOC. The pH of leachates from these sites was neutral to slightly basic and ranged between 6.98 and 7.8, whereas the literature reports values as low as 3.7. The high values of biological oxygen demand (BOD), chemical oxygen demand (COD), and total organic carbon (TOC) detected in leachates from these sites were at least an order of magnitude lower than the high values reported in the literature.

- Generally, there was no clear difference between the quality of the 13 leachate samples from the four municipal disposal sites and the 6 leachate samples from the two codisposal sites.

- The consistently neutral to basic pH of these leachate samples makes the acidic leaching solution of the EP and TCLP test questionable.

Inorganic Constituents

- Inorganic parameter concentrations detected in leachates from the four municipal disposal sites were similar to levels reported in the literature for leachates from other municipal disposal sites.

- Ranges of levels of inorganics detected in the leachates from the codisposal sites were similar to those reported in the literature for other sites. In general, there were very few reports on this subject.

- In general, there is no clear difference between inorganic content in leachates from the codisposal sites and from the municipal disposal sites.

- Inorganic parameter content in actual leachates collected from codisposal sites (this study and literature reported studies) was always lower than in test leachates (EP, TCLP or SW-924). The actual leachates always met the EP maximum allowable limit; the test-generated leachates periodically did not.

- A recently published EPA sponsored study, Composition of Leachates from Actual Hazardous Waste Sites, conducted by Science Application International Corporation (SAIC) for EPA under Contract 68-03-3113, Work Assignment 39-7, describes the collection of leachates from 13 carefully selected hazardous waste disposal sites. The inorganic constituents detected in leachates from the hazardous waste sites were at much higher concentrations than in the leachates collected from the four municipal waste disposal sites and from the codisposal sites.

Organic Constituents

- Very few organic compounds of the huge list of organics on Appendix IX were detected in the leachates from either the municipal waste disposal sites or the codisposal sites. Only 11 volatile compounds, 4 semivolatile compounds, and 5 pesticides were detected in these leachates. Concentrations of these compounds were very low.

- There is no difference in the number of compounds or in the detected levels between the leachates collected from the codisposal sites and those from the municipal disposal sites.

- Leachates generated from ashes collected from the codisposal sites by EP, TCLP or SW-924 leaching procedures did not generate detectable semivolatile compounds or PCBs.

- In the recently published, EPA-sponsored study in which leachates from 13 carefully selected, actual hazardous waste sites were analyzed for the same compounds, leachates from these hazardous sites contained 42 organic acids, 43 oxygenated/heteroatomic hydrocarbons, 39 halogenated hydrocarbons, 26 organic bases, 32 aromatic hydrocarbons, and 8 aliphatic hydrocarbons. The levels of these detected compounds ranged from a ppb level to many thousands of ppms.

PCDDs and PCDFs

- The leachates from the four municipal waste disposal sites were not analyzed for PCDDS or PCDFs. Only the actual leachates from the codisposal sites, the ashes from these sites, and the artificially generated leachates were analyzed for PCDDs and PCDFs.

- None of the analyzed samples contained 2,3,7,8-TCDD, which is the known most toxic homolog.

- The ashes contained ppb levels of total tetra, penta, hexa, hepta, and octa. PCDDs or PCDFs were not detected in TCLP-generated extracts; the EP toxicity procedure and SW-924 produced part-per-trillion levels of the octa (equivalent toxicity factor (ETF) 0.00) and hepta (ETF 0.001).

- The actual leachates contained only parts per trillion levels of octa, hepta, and hexa levels of PCDDs and octa, hepta, hexa, and penta levels of PCDFs. The 2,3,7,8-TCDD equivalents for these compounds are extremely low. These levels are extremely low.

- The ash at the NY site, which was from the beginning of a run and did not go through complete combustion, contained somewhat higher PCDD and PCDF levels than the second site (NC) ash.

- A recent Government of Canada publication claims that PCDDs and PCDFs are present in raw municipal waste.

Recommendations

- The data base for the general characterization and toxic characteristics of codisposal sites, as well as monofills, is very limited. Carefully conducted studies at such sites are essential.

- The data base for metal levels in test-generated leachates from ashes is large, but the relation between ashes and actually generated leachates in codisposal sites and monofills is almost absent. In this area, where additional studies are needed.

- Levels of PCDDs and PCDFs in leachates from municipal waste disposal sites should be determined.

- Levels of PCDDs and PCDFs in leachates from codisposal sites and monofills should be established and evaluated.

- Levels of semivolatile compounds in leachates from monofills should be established and evaluated.

WORK PLAN

1.0 INTRODUCTION

This Work Plan has been prepared for the United States Environmental Protection Agency (EPA) in response to Work Assignment No. 4 under Contract No 68-01-7310.

NUS herewith submits its work plan in response to Work Assignment No. 4. This Work Plan is based on general use of the NUS team staff required to assist the EPA project manager in developing data to evaluate the potential health and environmental effects of leachate from municipal landfills.

In 1979, EPA promulgated criteria for determining which Subtitle D (nonhazardous waste) disposal facilities pose a reasonable probability of adverse effects upon human health and the environment and therefore should be classified as "open dumps".

The Hazardous and Solid Waste Amendments of 1984 to RCRA require EPA, by November 8, 1987, to submit a report to Congress addressing whether the Subtitle D criteria authorized by RCRA Sections 1008(a) and 4004 Criteria (40 CFR Part 257) are adequate to protect human health and the environment from groundwater contamination, and recommending whether additional authorities are needed to enforce there criteria. Further, by March 31, 1988, EPA must revise the criteria for facilities that may receive hazardous household waste or small quantity generator hazardous waste.

Since 1984, studies conducted in support of this report to Congress, have raised concerns regarding the chemical composition of leachate generated from municipal waste landfills. These concerns center on the detection of certain toxic metals and organics, and on the lack of available data for a comprehensive and defensible evaluation of the effects of leachates on human health and the environment.

The purpose of the work described herein is to conduct field sampling and perform chemical analyses of leachate and municipal waste combustion (MWC) ash from municipal waste landfills to provide additional data for the detailed evaluation of potential health and environmental effects.

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CORPORATION
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GAITHERSBURG, MARYLAND 20878-1399
301-258-6000

January 19, 1987

Mr. Jon R. Perry
U.S. Environmental Protection Agency
Office of Solid Waste/Land Disposal Branch (WH-565E)
401 M Street, SW
Washington, DC 20460

Subject: EPA Contract No. 68-01-7310, Work Assignment
Work Plan No. 4, Revision 3

Dear Mr. Perry:

Enclosed please find a copy of the above-referenced Work Plan. If you have any questions, please don't hesitate to contact either myself or H. Roffman.

Sincerely,

Barbara E. Czerw

Barbara E. Czerw
Senior Contract Administrator
Government Contracts

/clr

cc: T. O'Connell, EPA (PM-214F)
R. Waller
G. Galida
M. Grossnickle
H. Roffman
File

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The purpose of the work described herein is to conduct field sampling and perform chemical analyses of leachate and municipal waste combustion (MWC) ash from municipal waste landfills to provide additional data for the detailed evaluation of potential health and environmental effects.

2.0 GENERAL SCOPE OF WORK

NUS Corporation (NUS) will provide support to EPA in determining municipal landfill leachate characteristics. To conduct this effort with a sound methodology, the work will be approached in two phases. Phase I involves developing a baseline for leachate characteristics through a review of existing data, and the collection and analysis of samples from six municipal landfills. Phase II will expand the data base through additional sample collection and analyses. The separate tasks in Phase I are described in the following sections.

TABLE 2-1

ANALYTICAL PARAMETERS, CONTAINERS AND PRESERVATIVES

SOURCE: Leachate

Number of Samples	Analysis	Container(s)*	Preservative**
20	Volatile Organics	(2) 40 ml vials	None
20	BNA Organics	(2) 1/2 gallon amber glass	None
20	Pesticide/Herbicide	(2) 1/2 gallon amber glass	None
20	Dioxin	(2) 1/2 gallon amber glass	None
20	Metals	(1) 1 liter PE	HNO_3 to pH <2
20	Cyanide	(1) 1 liter PE	NAOH to pH >12 If residual chlorine is present, add 0.6 g ascorbic acid
20	Sulfide	(1) 1 liter PE	2 ml of 2N zinc acetate, NaOH to pH >9

SOURCE: MWC Ash

2	EP Tox	1 liter wide-mouth glass	None
2	TCLP	1 quart	None
2	SW 924	1 quart	None
2	Metals	1 quart	None
2	PCBs	1 quart	None

* All containers will have Teflon-lined screw on lids

** All samples will be cooled to 4°C

3.0 DETAILED SCOPE OF WORK

3.1 Task 1 - Summary of Existing Leachate Data

Task 1 summarizes in report form existing leachate characteristics from data and reports supplied by EPA. This report supplies characteristics, including concentrations of organic and inorganic parameters.

This task also includes the preparation of a project overview including the study rational in a concise form.

3.2 Task 2 - Develop Detailed Work Plan

Develop a work plan describing site selection criteria, and field sampling protocols for collecting three (3) leachate samples at six (6) municipal landfills, and MWC ash samples from two (2) sites where such ash is co-disposed. This work plan also provides a description of analytical procedures for the eighteen field leachate samples and the extraction methods for the two solids ash samples. Validation and review procedures and a description of deliverables are also included in this plan. The detailed work plan is this document.

4.0 TASK 3 - SITE SELECTION

Criteria for site selection will be developed based on several factors including existence of a leachate collection system, accessibility and location of landfill, and the presence of a working incinerator for the MWC ash sites. A review of EPA data on all applicable sites will be completed and observations will be discussed with EPA's Hazardous Waste Engineering Laboratory in Cincinnati. Potential facilities will be reviewed by EPA with final selection being made by the EPA project manager.

4.1 Preliminary Survey of Facilities

The lead technicians for each sampling team, with the supervision of the Project Manager and the Task Manager, will make telephone contact with facility personnel in order to (1) acquaint facility personnel with the objectives of the study, (2) determine general operating characteristics of the facilities, (3) determine locations for sampling ash residues and field leachate, and (4) schedule dates for preliminary site inspection and sampling. A brief questionnaire will be developed to provide guidance for this telephone interview.

4.2 Initial Site Visit and Inspection

The lead technicians for each sampling team and the NUS Project Manager at his designee will visit each facility to obtain additional detail on facility operation, locate points of access for collecting residue samples, identify locations for sampling field leachate, and establish working relationships with facility personnel

4.3 Sampling Procedures

Introduction

The objective of field sampling and analysis in Phase I is to provide data to be used in determining municipal landfill leachate characteristics. All samples will be collected, handled and analyzed by qualified personnel in accordance with EPA approved protocols and methods. Field work will be conducted following site specific health and safety guidelines. In some cases, site conditions may dictate the use of additional personnel and equipment.

4.3.1 Sample Collection

Leachate Sample Collection

Based on the existence of a leachate collection system and its accessibility, six municipal landfills will be chosen for sampling. Three samples will be collected at each of the six landfills, with two samples for laboratory duplicate QA/QC.

Where possible, three separate collection points will be sampled at each landfill. Examples of probable locations are collection sumps and drainage ditches. Preferably, the samples will be collected by submerging the sample containers. Alternatively, they will be collected using stainless steel buckets attached to an aluminum handle or a length of polyethylene rope. All sample containers will be filled to capacity to prevent oxidation and precipitation of dissolved material.

4.3.2 MWC Ash Sample Collection

In addition to the leachate samples, one sample per site of MWC ash will be collected at two sites where ash is co-disposed.

The ash will be sampled prior to burial to ensure that its composition may be accurately evaluated. Samples will be collected using stainless steel spoons or scoops. Material will be collected from all parts of the ash deposit. An adequate volume will be collected to allow for laboratory QA/QC procedures.

Table 2-1 lists the number, analytical parameters, containers, and preservatives for all samples.

4.3.3 Sample Numbering

All samples will be assigned a field identification number to include codes for the site name, sample type and station number. The site name may be abbreviated using a two or three letter code such as ML. The sample type will be denoted as either LE, for leachate samples, or AH, for ash samples. The station number refers to a specific sampling location.

Example: A leachate sample collected at the first location would be designated ML-LE-001.

Duplicate samples will include the letter A directly after the station number.

4.3.4 Sample Documentation

All site activity and sampling will be documented in a waterproof, bound log book to be completed by the field team leader. Additionally, the following documents will be prepared in order to track each sample through shipping and analysis*:

- Sample labels - One per sample container, which will include date, time, sample number, analysis, and preservative.

- Traffic report forms - Two per sample, one for the organic aliquot plus one for the inorganic aliquot.

- Chain-of-custody forms - One per sample shipment to an individual laboratory.

- Chain-of-custody seals - Two per cooler, affixed so that the cooler cannot be opened without breaking the seals.

- Airbills - One per sample shipment to an individual laboratory.

4.3.5 Sampling Handling

All samples will be placed on ice in a cooler immediately after collection. Required preservatives will be added as soon as possible after collection. The subsequent list of procedures will then be followed:

- Complete proper decontamination
- Tighten and secure the lid of each container
- Seal each container in a watertight plastic bag

Samples will be shipped the day they are collected via a qualified carrier for next day delivery.

---

* Procedures follow CLP documentation protocols.

4.3.6 Sample Packaging and Shipping

In order to ensure that the laboratories will receive enough sample volume, all samples will be treated as environmental samples. The following steps will be taken during packaging and shipping:

- Plug drain and line cooler with a large impervious plastic sheet.
- Place samples in cooler.
- Include several watertight ice packs.
- Fill with a light, absorbent packing material such as vermiculite.
- Place laboratory copies of sample documentation in a sealed plastic bag and tape to cooler lid.
- Affix custody seals.
- Secure cooler with strapping tape.
- The traffic report forms will indicate if the field team feels that a sample may be of medium concentration.

4.3.7 Equipment Decontamination

Dedicated disposable or lab cleaned equipment will be used to collect all samples. After use, any nondisposable equipment will be decontaminated by the following procedure*:

---

*Procedures may be altered depending according to regional protocols.

- Tap water and laboratory grade soap wash
- Tap water rinse
- 10 percent nitric acid solution rinse
- DI water rinse
- Solvent rinse
- DI water rinse
- Air dry
- Wrap in foil and store in a secure area

4.4 Conduct Analyses

Samples collected during this study will consist of two basic types of media: field leachate samples and MWC ash. In the laboratory a leachate will be generated from the MWC ash. Both the field leachate and the leachate prepared from the ash in the laboratory will be analyzed for various inorganic and organic compounds.

4.4.1 Field Leachate Analyses

Leachate samples collected from the field will be analyzed for volatile organics, BNA organics, pesticide - herbicides, dioxin, metals, cyanide and sulfide as listed in Appendix IX.

Volatile compounds will be analyzed by a modified EPA Method 624. This is very similar to Method 8240 from SW-846 utilizing different surrogates and internal standards. Tuning criteria for bromofluorobenzene will follow the Contract Laboratory Program (CLP) requirements. A three level initial calibration curve will be analyzed for all Appendix IX compounds and response factors checked daily with the mid-point solution. As per CLP requirements selected compounds will be checked to meet minimum response factor requirements in both the initial and continuing calibration analyses. Other representative compounds will be checked to determine the linearity of the initial calibration curve response factors with a limit of less than 30 percent difference from the mean response factor. These compounds' response factors will be calculated and a percent difference of less than 25 percent from the initial calibration curve mean response factor will be the criteria to be met prior to sample analysis.

Semivolatile compounds will be analyzed by a modified EPA Method 625 which is very similar to SW-846 Method 8270, once again utilizing different internal standards and surrogate compounds. Mass spectrometer tuning will be CLP DFTPP criteria. Once again a three-point initial calibration curve will be analyzed for all Appendix IX compounds and response factors checked to meet minimum response factors and a 30 percent maximum percent difference from the mean for selected representative compounds. These response factors will be checked daily with the mid-point standard, once again meeting minimum response factor and a 25 percent difference from the mean response factor prior to sample analysis.

Herbicide and pesticide analysis will be determined by proposed Method 1618. This method is a consolidation and modification of Sw-846 methods. These modifications are listed below:

- Phenoxyacid Herbicide Extraction (Method 8150)

  Ether extraction of samples will be replaced with methylene chloride extraction for aqueous samples and methylene chloride/acetone (1:1 v/v) extraction for solids. S-CUBED had reasonable precision and accuracy for the recovery of matrix spikes from real-world soil and sludge samples using methylene chloride and methylene chloride/acetone, while ether extraction did not work for POTW samples.

- Megabore Capillary GC (Method 8080 and 8150)

  Packed column GC analysis lacks the resolution to separate analytes from each other or from matrix interference peaks in complex environmental samples. Our experience in analyzing sludge samples and in the validation of the new CLP Pesticide Protocol has demonstrated that identification of peaks using megabore capillary analysis is less ambiguous than with packed column and that quantitation is more precise with capillary. In addition, the use of capillary analysis allows determination of more Appendix IX analytes than does packed column analysis.

- Clean-up Cartridge (Method 8080)

  The use of these cartridges greatly increase the throughput of samples in the laboratory. Based on our experience with the validation of the new CLP pesticide method, sample preparation with Florisil or slumina column chromatography is slower and less reproducible than with cartridges.

Matrix spike compounds are listed in the method. Recovery limits will be as listed on the CLP forms for the organochlorine pesticides. The limits are in the process of being determined (through an interlaboratory study) for the organophosphorus and phenoxyacid compounds.

Dioxins and furans will be determined by SW-846 8280 with no modifications. Metals will be determined by the listed SW-846 on EPA methods without modification. All QC requirements of the above methods will be carried out.

Extraction of samples will be started within 24 hours of sample receipt. Volatile analyses will be completed within seven days of sample receipt. All samples will be kept sealed, cold and in the dark prior to extraction or analysis to preclude sample degradation and/or precipitation of target compounds. Extracts will be stored at 4°C when not in use.

Samples and extracts will be retained for 60 days after the submission of the data unless otherwise requested. All GC/MS information will be stored on magnetic tape for a minimum of three years. Raw dat¬ (including GC chromatograms) will be retained fro the same period.

4.4.2 MWC Ash Analysis

Laboratory leachates will be prepared from the MWC ash by three different extraction procedures: the Extraction Procedure (EP), the Toxicity Characteristic Leaching Procedure (TCLP) and two sequential aqueous extractions by SW-924. Analyses to be performed on the ash generated leachate includes, total organic carbon, total metals, an organic scan, PCDD/PCDF, and PCB analyses. Total organic carbon analysis will only be performed on the laboratory leachates prepared by the SW-924 procedure.

An organic scan will be performed on all laboratory leachates to determine whether organic compounds other than PCDDs, PCDFs and PCBs are present. If the results of the total organic carbon (TOC) determination and the organic scan suggest that significant concentrations of organics other than PCDD/PCDF/PCB are present, the laboratory leachates will be solvent extracted and the compounds in each extract fraction (base/neutral, acid) will be identified and quantified using GC/MS techniques. Thus these analyses will be performed contingent upon the results of the required analyses. The TOC, organic scan, and any subsequent GC/MS analyses will quantify the total organic content of the laboratory leachates.

Analyses for polychlorinated dibenzo dioxins (PCDDs) and polychlorinated dibenzo furons (PCDFs) will be performed on all laboratory generated leachates.

5.0 TASK 4 - DATA VALIDATION

Data obtained from the Appendix IX analysis of the leachate and MWC ash samples will be reviewed (validated), reduced and evaluated by NUS qualified chemists. All chemical analytical data will be validated according to QA-Standards similar to those established by EPA for CLP data. This data review is independent of internal validations performed by the laboratory.

6.0 TASK 5 - PREPARE DATA REPORT

Analytical results and site information will be submitted in a report form to the EPA project manager. This report will include quality assurance and quality control records and an evaluation of the sampling and analytical methodologies used for these types of samples and analyses.

S-CUBED
A Division of Maxwell Laboratories, Inc.

October 16, 1986

Dr. Haia Roffman
NUS Corporation
Park West Two
Cliff Mine Road
Pittsburgh, PA 15275

Dear Dr. Roffman:

This letter is to follow up and expand upon the methods S-CUBED plans to utilize for the analysis of leachate samples for Appendix IX compounds. This letter will also outline expected Quality Control (QC) goals for surrogate and matrix spike recoveries.

Volatile compounds will be analyzed modified by EPA Method 624. This is very similar to Method 8240 from SW-846 utilizing different surrogates and internal standards. Tuning criteria for bromofluorobenzene will follow the Contract Laboratory Program (CLP) requirements. A three level initial calibration curve will be analyzed for all Appendix IX compounds and response factors checked daily with the mid-point solution. As per CLP requirements selected compounds will be checked to meet minimum response factor requirements in both the initial and continuing calibration analyses. Other representative compounds will be checked to determine the linearity of the initial calibration curve response factors with a limit of less than ± 30 percent difference from the mean response factor. These compounds' response factors will be calculated and a percent difference of less than ± 25 percent from the initial calibration curve mean response factor will be the criteria to be met prior to sample analysis.

Semivolatile compounds will be analyzed by a modified EPA Method 625 which is very similar to SW-846 Method 8270, once again utilizing different internal standards and surrogate compounds. Mass spectrometer tuning will be CLP DFTPP criteria. Once again a three-point initial calibration curve will be analyzed for all Appendix IX compounds and response factors checked to meet minimum response factors and a 30 percent maximum percent difference from the mean for selected representative compounds. These response factors will be checked daily with the mid-point standard, once again meeting minimum response factor and a ± 25 percent difference from the mean response factor prior to sample analysis.

P.O. Box 1620, La Jolla, California 92038-1620 3398 Carmel Mountain Road, San Diego, California 92121-1095
Tel: (619) 453-0060 TWX: 910-337-1253 Telecopier: (619) 755-0474

Included as enclosures to this letter are copies of the CLP QC forms and a list of internal standards and surrogates to be used on this project. The surrogates limits will be strictly adhered to, with reanalysis of samples which do not meet criteria when sufficient sample is available. Matrix spike and duplicate analysis criteria are guidelines in the sense that these data are utilized to give information on the precision and accuracy of the method for samples of this particular matrix. Reanalysis will not be performed if these goals are not met unless there is an obvious laboratory error (in which case re-extraction will be carried out if there is sufficient sample). We expect there will be enough sample volume to reanalyze all but the sample chosen for matrix analyses.

Also included in this package is a copy of proposed Method 1618. This is essentially a consolidation and modification of SW-846 methods. These modifications are listed below:

(1) **Phenoxyacid Herbicide Extraction (Method 8150)**

Ether extraction of samples will be replaced with methylene chloride extraction for aqueous samples and methylene chloride/acetone (1:1 v/v) extraction for solids. S-CUBED had reasonable precision and accuracy for the recovery of matrix spikes from real-world soil and sludge samples using methylene chloride and methylene chloride/acetone, while ether extraction did not work for POTW samples.

(2) **Megabore Capillary GC (Method 8080 and 8150)**

Packed column GC analysis lacks the resolution to separate analytes from each other or from matrix interference peaks in complex environmental samples. Our experience in analyzing sludge samples and in the validation of the new CLP Pesticide Protocol has demonstrated that identification of peaks using megabore capillary analysis is less ambiguous than with packed column and that quantitation is more precise with capillary. In addition, the use of capillary analysis allows determination of more Appendix IX analytes than does packed column analysis.

(3) **Clean-up Cartridge (Method 8080)**

The use of these cartridges greatly increase the throughput of samples in the laboratory. Based on our experience with the validation of the new CLP pesticide method, sample preparation with Florisil or alumina column chromatography is slower and less reproducible than with cartridges.

Matrix spike compounds are listed in the method. Recovery limits will be as listed on the CLP forms for the organochlorine pesticides. The limits are in the process of being determined (through an interlaboratory study) for the organophosphorus and phenoxyacid compounds.

At this point this method does not use surrogates. The CLP surrogate dibutyl chlorendate has been determined to be ineffective due to degradation problems. S-CUBED is currently investigating the use of hexabromobenzene as a surrogate. If NUS requests the use of a surrogate, S-CUBED will include this compound and report the recoveries. Since no recovery limits have been determined no corrective action (for high or low recoveries) is anticipated.

Dioxins and furans (if necessary) will be determined by SW-846 8280 with no modifications. As outlined in our previous communications, metals will be determined by the listed SW-846 on EPA methods without modification. All QC requirements of the above methods will be carried out.

Extraction of samples will be started within 24 hours of sample receipt. Volatile analyses will be completed within seven days of sample receipt. All samples will be kept sealed, cold and in the dark prior to extraction or analysis to preclude sample degradation and/or precipitation of target compounds. Extracts will be stored at 4°C when not in use.

Samples and extracts will be retained for 60 days after the submission of the data unless otherwise requested. All GC/MS information will be stored on magnetic tape for a minimum of three years. Raw data (including GC chromatograms) will be retained for the same period.

I hope this gives you sufficient information to write your work plan. Please give me a call if you need to modify any of the QC goals or if further information is necessary.

Sincerely,

JoAnn Wilkinson
GC/MS Laboratory Supervisor

/alb

cc: B. Blackburn
G. Swanson

APPENDIX B

NUS CASE STUDIES

B1 - VD Landfill
Final Draft by PEI Associates, Inc.
Contract No. 68-02-3890
Work Assignment No. 27
Project Officer: Mike Flynn
June 1986

B2 - FL Municipal Solid Waste Site
Preliminary Draft by SRW Associates, Inc.
Contract No.
Work Assignment No.
Project Officer:
June 1986

B3 - SM Landfill
Draft by ICF Northwest
Contract No. 68-01-7290
Work Assignment No. 25
Project Officer: Ronald McHugh
August 1986

B4 - PC Landfill
Draft by ICF Northwest
Contract No. 68-01-7290
Work Assignment No. 25
Project Officer: Ronald McHugh
July 1986

CASE STUDY

VD LANDFILL

Final Draft

by

PEI Associates, Inc.
1133 15th Street, N.W.
Suite 205
Washington, D.C. 20005

Contract No. 68-02-3890
Work Assignment No. 27
PEI Project No. 3655-27

Project Officer

Mike Flynn

U.S. ENVIRONMENTAL PROTECTION AGENCY
401 M STREET, S.W.
WASHINGTON, D.C. 20460

June 1987

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SUMMARY FACT SHEET

Key elements of this case study include:

- The landfill is located in a drainage area that is intermittently covered with surface water that drains from the nearby foothills and mountains.
- The landfill design includes an upstream diversion ditch to route surface water around the fill, and a downhill leachate collection pond to contain leachate seeping from the fill.
- No shallow ground water or wells are in the vicinity of the landfill.
- The landfill is unlined.
- Problems have arisen at the landfill with slumping of the diversion ditches and overtopping of the leachate collection pond.
- No monitoring data are collected at the landfill.

1.0 GENERAL NARRATIVE DESCRIPTION

The VD Landfill is a small privately operated facility. The 100-acre site is divided into two phases: Phase I consists of 12 acres of fill area, and Phase II consists of 18 acres of fill area. The landfill is located in a large drainage ravine. Because of its topography, the site has been characterized as "extremely poor to unacceptable" by the Geological Survey in the preliminary plan for the landfill, submitted in December 1978. Situated in a drainage area with shallow sandy soil and steep slopes, the site was evaluated as having a high potential for problems with run-on and runoff, erosion, unstable slopes and high maintenance of diversion ditches, slopes, and roads. In January 1979, the Department of Health also concluded that the property was "...a poor candidate for a solid waste disposal site, and significant improvements will be required prior to any consideration of this site." Despite these evaluations, the site was approved for use as a landfill in 1979. It was opened in late 1979, and operations began in January 1980.

Phase I is currently full and in the process of being closed. Phase I has not been approved as of April 1986. Problems have occurred with leachate seeping through the settling ponds and running downhill. Additional identified problems are improper compaction, questionable cell structure, and lack of methane and leachate control devices.

2.0 DETAILED DESCRIPTION

2.1 GENERAL

The VD Landfill was designed to include two fill areas. The Phase I fill area covers 12 acres, and the Phase II area covers 18 acres. The operations plan states that cells will be filled daily by a ramp method. The cells are 25 feet wide by 30 feet long and are 6 feet deep.

Operations began in the Phase I area in January 1980, and this area is currently full. An application for approval of operations in the Phase II area has not yet been submitted (as of April 1986). The Phase I fill operated 5 days per week and accepted about 75 tons per day, or 185 cubic yards compacted.

The immediately surrounding land is undeveloped. This area, which is part of the foothils that rise from the floor of the Valley, which is dissected by numerous ridges and ravines. The site is characterized as a draw, or canyon, with sloping sides of weathered shale underlain by deep shale formations. The shale is covered with up to 10 feet of slope-wash deposited soils and residual soils. The slope wash and residual soils are mainly clays but include angular sand- to gravel-size shale fragments that are nonstratified. The alluvial sand and sheet-wash-deposited soils are similar in composition to the slope wash and residual soils and are poorly stratified. The subsurface investigation conducted at the site identified up to 10 feet of silty clay over shale, with permeabilities ranging from 1×10^{-6} to 2.1×10^{-8} cm/s.

There are no wells in the area because of the lack of ground water in the shale bedrock. Only a few seasonal seeps occur along the shale bedding joints.

2.2 WASTE CHARACTERISTICS

Phase I of the fill accepted municipal solid waste and construction debris and maintained separate pits for dead animals and sludge. Hazardous or toxic wastes, POTW liquid wastes, septic tank wastes and liquid industrial wastes were not accepted.

No data in the files provided information on volumes of waste in place. According to the design, the landfill accepted 75 tons per day, or 185 cubic yards, compacted, 5 days per week for 7 years; thus, the completed Phase I area could contain about 136,500 tons of waste (or 336,700 cubic yards, compacted). The files do not provide any data on the relative composition of the waste with respect to percentage of industrial waste, municipal waste, sludge, etc.

2.3 DESIGN CHARACTERISTICS

The landfill permit application states that leachate will be minimized by the in-place "clayish" topsoil. The application further states that there will be 2 to 6 feet of "dense tight clay" underneath any refuse cell. No synthetic or constructed clay liner was installed at the landfill.

2.3.1 Leachate Collection

The operational plan for the landfill includes a leachate reservoir on the downgradient side of the landfill. Figures 1 and 2 show the location of construction of the leachate reservoir and the earthen dam around it. The plan called for the surface and subsurface water collected in the leachate reservoir to be used for fire control and for revegetation. A memo issued before the landfill began operating, mentioned several alternatives for leachate handling, including recycling on the landfill or discharge to the sanitary system. The latter alternative evidently was not pursued because the file makes no mention of an NPDES permit. A newspaper article in the file implies that the collected leachate was pumped to sprinklers and sprayed back over the landlfill.

2.3.2 Gas Control

The drawings and operational plan include methane gas control devices, as shown in Figure 3; however, the files indicate that these were never installed.

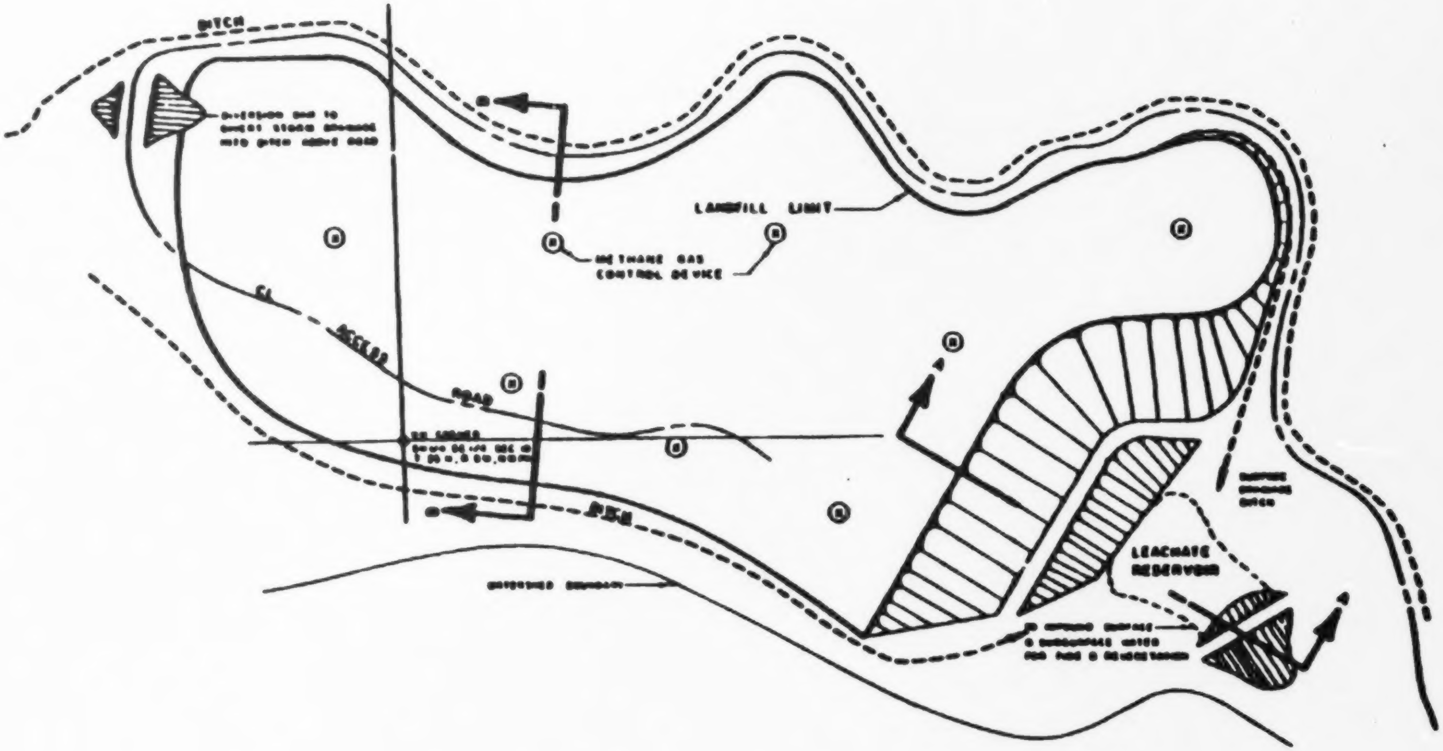
DITCH
LANDFILL LIMIT
METHANE GAS CONTROL DEVICE
CL ACCESS ROAD
DITCH
LEACHATE RESERVOIR

Figure 1. Phase I plan.

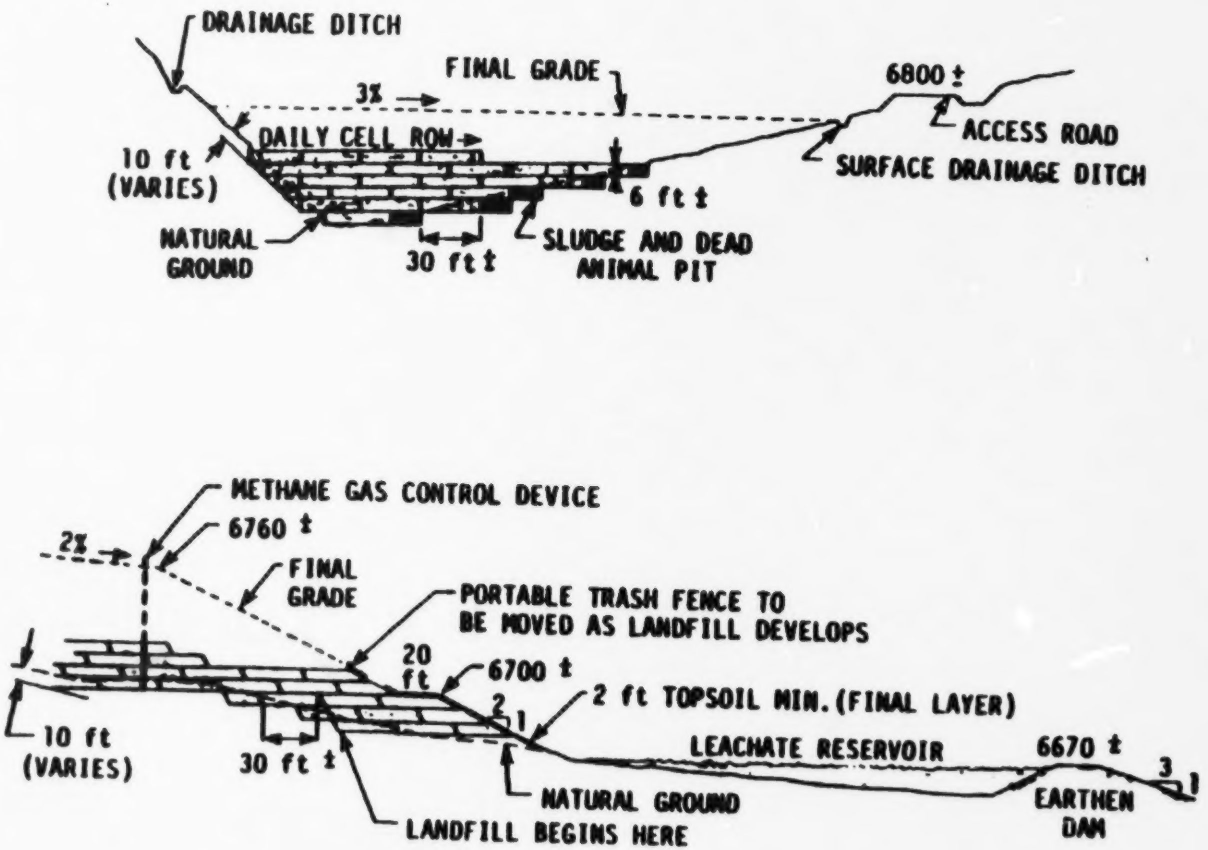
DRAINAGE DITCH
FINAL GRADE
3% →
6800 ±
ACCESS ROAD
SURFACE DRAINAGE DITCH
DAILY CELL ROW →
10 ft
(VARIES)
6 ft ±
NATURAL
GROUND
30 ft ±
SLUDGE AND DEAD
ANIMAL PIT
METHANE GAS CONTROL DEVICE
6760 ±
2% →
FINAL
GRADE
PORTABLE TRASH FENCE TO
BE MOVED AS LANDFILL DEVELOPS
20
ft
6700 ±
2
1
2 ft TOPSOIL MIN. (FINAL LAYER)
LEACHATE RESERVOIR
6670 ±
3
1
10 ft
(VARIES)
30 ft ±
NATURAL GROUND
LANDFILL BEGINS HERE
EARTHEN
DAM

Figure 2 Cross section of landfill showing cell construction and leachate reservoir.

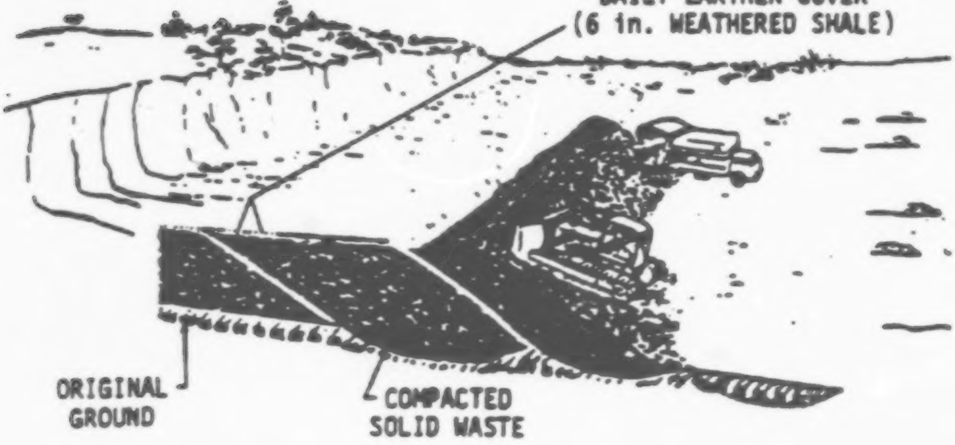
DAILY EARTHEN COVER
(6 in. WEATHERED SHALE)
ORIGINAL GROUND
COMPACTED SOLID WASTE

Figure 3. Ramp variation of area method of cell construction.

2.3.3 Run-on/Runoff Controls

Run-on and runoff controls are a major design feature of this landfill. The site is in a ravine. Because the area is occasionally covered with surface-water flow, the landfill was designed with a drainage diversion ditch around the fill area. A diversion dam is located on the upstream end of the fill to divert storm drainage into the ditch (see Figure 1). The ditch is designed to contain twice the volume of rain and runoff of a 100-year flood. A consultant's report recommended that the ditches be lined with asphalt; however, they stayed unlined so that heavy equipment could be operated in them.

2.4 OPERATION AND MANAGEMENT PRACTICES

The ramp method of filling (see Figure 3) was used at the site to construct and fill daily cells. The daily cover was excavated to make a trench for the cell; the excavated soil was placed on the previously completed cell to help compact the refuse. The development plan submitted to the county states that a minimum of 6 inches of cover material composed of weathered shale will be utilized to cover each cell and compacted lift to prevent the blowing of trash. A minimum depth of 2 feet of compacted topsoil cover material is to be used over the final lift upon completion of final grades.

The permit application and development plan state that leachate will be collected in the leachate rerservoir and that it may be used for dust control, revegetation, or reapplication to the landfill, or it may be discharged to the Wastewater Treatment Plant. The files indicate that the leachate was evaporated when possible or was sprinkled back over the landfill surface.

The development plan and the permit application state that gas recovery devices (see Figure 4) would be constructed in the fill; however, letters and memos in the State files indicate that these devices had not been installed as of October 1985. The files do not include information on whether these devices might have been installed in late 1985 or 1986.

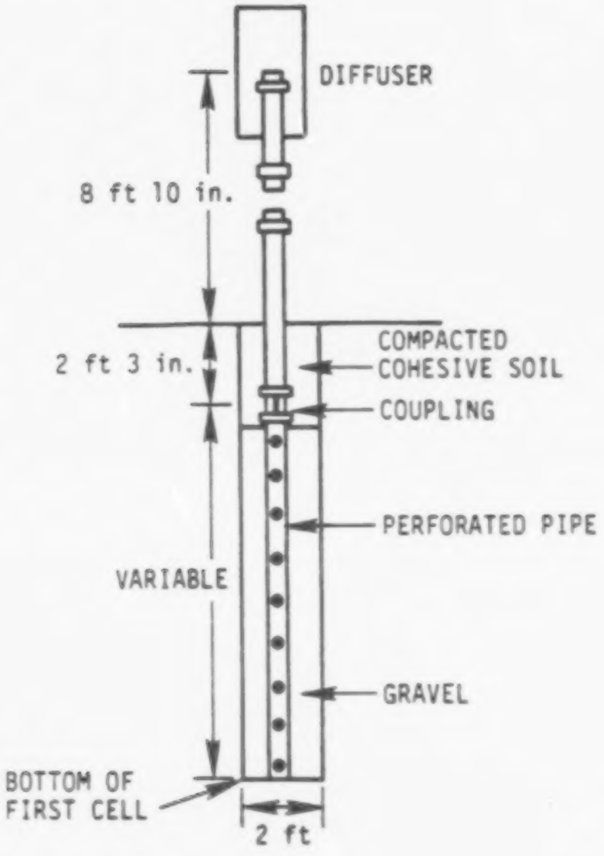
DIFFUSER
8 ft 10 in.
2 ft 3 in.
COMPACTED
COHESIVE SOIL
COUPLING
PERFORATED PIPE
VARIABLE
GRAVEL
BOTTOM OF
FIRST CELL
2 ft

Figure 4. Methane gas control device.

A search of the State files did not reveal any information on remedial actions taken at the VD Landfill. A memo and a newspaper article mention problems with leachate seepage and slumping of diversion ditches, but the solutions (if any were taken) to these problems are not addressed in the files reviewed.

3.0 ENVIRONMENTAL IMPACT

3.1 MONITORING DATA

The State file contains no monitoring data.

3 2 DAMAGE ASSESSMENT

In a memo dated May 1980, 4 months after the VD Landfill began operation, a representative of the Department of Health described some damage noted during an inspection. Surface water in the interceptor trenches was soaking through the trench and seeping into natural drainage ravines. The water then passed through the fill and became impounded in the dams below the fill. The memo states that both impoundments were constructed of non-compacted earth and that they had slumped so badly they were in danger of failure. The uppermost impoundment was being siphoned into the lower impoundment, which was overtopping. Leachate was being discharged by the lower impoundment into the natural drainageway that flows 1 mile away. The leachate overtopping the bottom impoundment was being discharged at a rate of more than 15 gallons per minute. Trash was floating in the waters of the uppermost impoundment.

In an October 1985 memo covering a survey of the landfill, the following observations were made: 1) methane gas control devices were not in place as shown on the operational plan; 2) no dead animal and sludge pits were noted as mentioned in the narrative of the operational plan; 3) nor portable fencing was seen as mentioned in the narrative of the operational plan; and 4) revegetation or reclamation efforts were not evident.

In a newspaper article included in the State files (no date provided), the author described the seepage of a bright orange liquid through the settling ponds at the landfill, which was flowing downhill. The article says that the site operators acknowledged the problem and were making plans to remedy it. The article described the settling ponds as water-permeable shale and said that the leachate collected in them normally evaporates before causing a problem. The article further stated that the operators completed compaction of the pond banks as ordered by the Health Department, but that no other remedial action, such as lining the ponds or treating the leachate have been taken. The author further indicated that the operators applied to the State Water Quality Control Commission for a discharge permit.

The files reviewed do not contain information on any effects on human health and the environment from the VD Landlfill.

3.3 CORRECTIVE ACTION

The aforementioned newspaper article in the file states that the operator will be required to correct leachate seepage problems at the landlfill, but there is no further discussion of the actions required or taken.

4.0 COST DATA

No cost data are available.

CASE STUDY

FL MUNICIPAL SOLID WASTE SITE

by

SRW Associates Inc.
A Subsidiary of ICF Technology Incorporated
2793 Noblestown Road
Pittsburgh, Pennsylvania 15205

Contract No.
Work Assignment No.

Project Officer

Work Assignment Manager
Jim Pittman

U.S. ENVIRONMENTAL PROTECTION AGENCY
401 M STREET, S.W.
WASHINGTON, D.C. 20460

June 1986

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SUMMARY FACT SHEET

Key elements of this case study include the following:

- The 120 acre site is owned and operated by the city.
- The city was granted a permit to construct the Class I Sanitary Landfill on January 17, 1985.
- The initial operating permit was granted on May 23, 1975. Two subsequent operating permits were granted in April 1980 and on December 4, 1985. The expiration date of the latest permit is November 1, 1990.
- The projected closure date is 1992.
- The land use adjacent to the site is primarily forest, except for the access road to the site which is residential.
- The soils underlying the site consist of a medium to fine-grained sand to a depth of about 40 feet below the ground surface. The medium to fine sand was reported to be underlain by silty to clayey sand to a depth of at least 50 feet below the ground surface.
- The sequential trench method of disposal is being utilized at this site.
- A bentonite-polymer soil liner is to be installed along the bottom and side slopes of new cells. The liner is to reduce the permeability of the material adjacent to the wastes to 1×10^{-7} cm/sec.
- The groundwater regime underlying the site consists of three separate aquifer systems. These aquifer systems are a surficial unconfined aquifer, an upper artesian aquifer, and a deeper aquifer.

SUMMARY FACT SHEET (continued)

- It is estimated from the water balance calculations performed for this site, the leachate production from this landfill is about 17 million gallons per year.

- A leachate collection plan is to be installed in the unused portion of one cell and in three proposed cells.

- No significant methane production is anticipated; however, provisions for methane venting and monitoring is included in the latest permit application in case significant quantities of methane are encountered.

- A groundwater monitoring plan consisting of five monitoring wells is included in the latest permit. Three of the monitoring wells were developed in the surficial aquifer downgradient from the landfill. Another of the monitoring wells was developed in the deeper aquifer. The fifth monitoring well was developed in the surficial aquifer upgradient of the landfill.

- No monitoring of gas, surface water or the upper artesian aquifer was proposed.

1.0 GENERAL NARRATIVE DESCRIPTION

The FL Landfill is a currently operating facility. Construction Permit No. was issued on January 17, 1975 to permit construction activities for this landfill. The initial operating permit was issued on May 23, 1975 to allow this landfill to begin accepting wastes. Two subsequent operating permits have been issued for this site with the latest operating permit issued on December 4, 1985 for the period of December 4, 1985 to November 1, 1990.

The operating permit application dated March 8, 1985 indicated the method for disposing of the wastes was the sequential trench method with a yard trash composting pile, a tomato waste pit, and a wood chip and fiberboard open stock-pile. The March 1985 operating permit application indicated seven cells with several areas for additional cells. Three of the cells (Nos. 1, 2 and 5) were previously filled. Another cell (No. 3) was in operation, one cell (No. 4) was about completely excavated, and two additional cells (Nos. 6 and 7) were proposed.

The existing cells were excavated to a depth of between 10 and 30 feet. The proposed cells were shown as excavated to a depth of 30 feet. The sizes of the cells at the ground surface varied from 1,260 feet long by 50 feet wide to 350 feet long by 120 feet wide. The side slopes for the existing cells were not indicated, while the side slopes for Cells 6 and 7 were shown as 2 horizontal to 1 vertical. The estimated life for the remainder of Cell 3 and Cells 4, 6, and 7 was about 7 years.

The 120 acre landfill is located on land of which 100 acres is owned by the city and the remaining 20 acres are owned by the county. The topographic relief varied from 130 feet NGVD to 230 feet NGVD. The land adjacent to the site is generally forest in which timber operations have been conducted. The land use for areas adjacent to the access road to the landfill is residential.

The FL Landfill accepts municipal wastes, wastes from a furniture manufacturing plant, and a tomato packing plant and wastes from a hospital. The landfill serves a population of about 9,000. The estimated quantity of wastes was about 75 cubic yards per day in the 1985 operating permit application.

In the December 1974 construction permit application, wastes were shown to be placed in 6 foot lifts and covered daily. Additionally, both an intermediate and final cover were to be placed over the refuse. A leachate collection system was also shown in this application. This leachate collection system consisted of a 4 inch perforated pipe in a sand filter. This leachate collection system was placed at the base of each side slope.

The March 1985 operating permit application stated a leachate collection system which would be installed in the unused portion of Cell 3 and in Cells 4, 6 and 7. Additionally, the bottom of Cells 3, 4, 6, and 7 was to be graded at a minimum slope of 2 percent to the south, a bentonite polymer soil liner with a permeability of 1 x 10^{-7} cm/sec. was to be installed along the bottom of Cells 4, 6, and 7, and along the sides of Cells 6 and 7. The leachate collection system consisted of a trench beneath the base of each trench and installation of a 6 inch PVC in a gravel filter in each trench. The 6 inch PVC pipes were shown flowing into one of two lift stations where the leachate would be pumped to a sealed leachate pond. The leachate would be allowed to evaporate and trucked to a sanitary treatment plant for treatment.

The bentonite-polymer soil liner consisted of mixing the bentonite polymer with the top 6 inches of material in contact with the wastes. The quantity of the bentonite polymer would be sufficient so that a permeability of 1 x 10^{-7} cm/sec. was obtained after compaction of the mixture.

A Special Report estimated that 17 million gallons per year could be produced from this landfill. This report also estimated it would take 6.5 years before the leachate would first appear.

2.0 DETAILED ESTABLISHMENT DESCRIPTION

2.1 GENERAL

The March 1985 permit application stated the soil profile consisted of about 40 feet of slightly silty medium to fine grain sand (SP-SM) interlayered with silty and clayey sands (SM-SC). Underlying the medium to fine grain sands was a 10 foot thick layer of silty and clayey sands (SM-SC). Bedrock beneath the site consists of, in descending order: Miocene Age Hawthorne Formation, Miocene Age Tampa Limestone, Oliogene Age Suwanee Limestone, and Eocene Age Ocala Limestone.

The Hawthorn Formation is composed of a sequence of highly variable clays, sands and interbedded limestone with no dominant lithologic type. The thickness of the Hawthorn Formation was estimated to be about 200 feet at the FL Landfill. The Tampa Limestone was described as a gray sandy, micritic to crystalline, argillaceous limestone with the top of this unit at a depth of 200 feet below the ground surface. The thickness of the Tampa Limestone is about 140 feet at this site.

The Suwanee Limestone was described in the March 1985 permit application as a crystallized, highly dolomitic, fossiliferous limestone containing thin beds of dolomitic clays. The Suwanee Limestone was estimated to occur at a depth of 340 feet and to be about 160 feet thick at this site. The Ocala Limestone was described as a micritic to crystalline fossiliferous limestone. Additionally, the formation was described as highly dolomitic near the top of the unit and contains some calcareous clay. The Ocala Limestone was estimated to occur at a depth of about 500 feet below the site and was about 310 feet thick.

The May 1984 Groundwater Monitoring Plan prepared by a Consulting Engineers Company indicated three aquifers in the groundwater regime beneath the site. One of the aquifers is an unconfined surficial aquifer consisting of about 50 feet of sandy soils at the site. The aquifer is generally not used as well yields are generally less than 5 gpm.

Below the surficial aquifer, the groundwater regime consists of two artesian aquifers, which are the upper artesian aquifer and a deeper aquifer. The upper artesian aquifer consists of beds of sandy limestones near the base of the Hawthorn Formation. The specific capacity of wells developed in this highly variable aquifer is reported to average 5 gpm or less. There were no report users of this aquifer in the vicinity of the FL Landfill.

The stratigraphically lowest aquifer beneath the landfill is reported to be over 1,000 feet thick beneath this site. This aquifer is the major source of potable water in the area.

Monitoring well MW-3 was developed in the Tampa Limestone. The specific capacity of this well was 0.9 gpm per foot of drawdown. The results of a pump test in a well several miles to the east of the site and cased through the upper unit yielded a transmissivity of 1,260 square feet per day and a storage capacity of 2.6×10^{-4}.

In-situ variable head permeability tests were performed for the four monitoring wells in the surficial aquifer. The test results indicated the in-place permeability ranged from 2.0×10^{-4} cm/sec. to 6.8×10^{-5} cm/sec.

Water levels were obtained on December 18, 1985 in monitoring wells MW-1, MW-2, MW-4 and MW-5. These measurements indicated the groundwater elevation varied from an elevation of 182.6 in MW-1 to an elevation of 172.79 in MW-2. Test results of groundwater samples collected on December 18, 1985 indicated a slightly higher concentration of most parameters downgradient from the landfill. The highest concentrations were obtained in Monitoring well MW-5, which is the closest monitoring well downgradient of the landfill.

The March 1985 operating permit application indicated the FL Landfill consisted of seven cells, a yard trash composting pile, a tomato waste pit, a wood chip and fiber board open stockpile, and two areas for additional cells. The sequential trench method was shown as the method for disposing of the wastes. Three of the seven trenches (Nos. 1, 2, and 5) were filled, but needed a final cover. Cell 3 was about completely excavated. The material excavated from Cell 4 was being used as daily and intermediate cover for Cell 3. Cells 6 and 7 were proposed for future waste disposal. It was estimated Cells 6 and 7, and the additional areas, would be filled by 1992. The size of the cells varied at the ground surface from 1,260 feet long by 50 feet wide for Cells 1 and 2 to 350 feet long by 120 feet wide for Cell 7.

Construction permit was issued on January 17, 1985 to begin construction of this landfill. The initial operating permit was issued on May 23, 1975, at which time the landfill began accepting wastes. Two subsequent operating permits have been issued for this site with the latest permit for the period of December 4, 1985 to November 1, 1990.

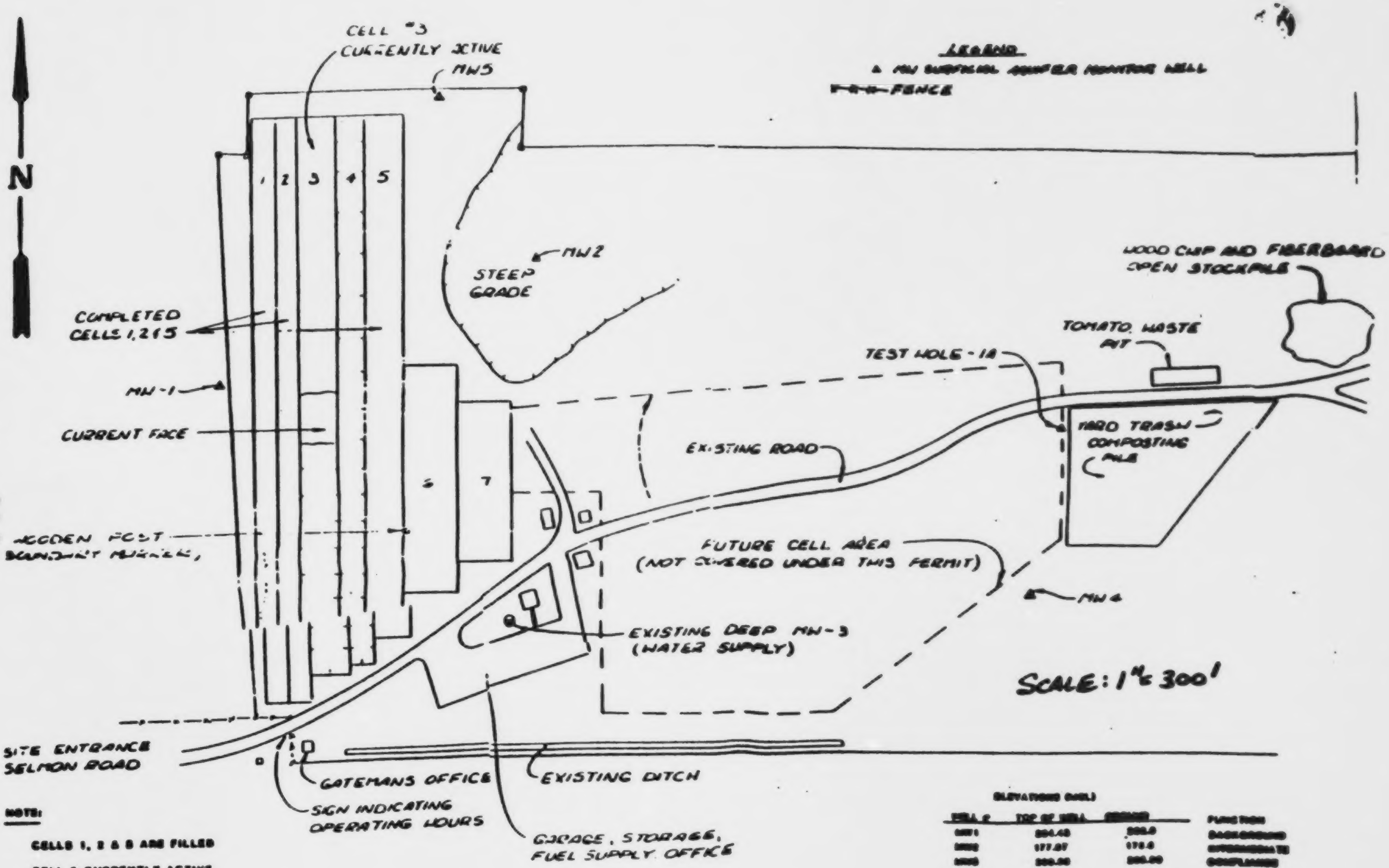
The site is located on a hilltop which slopes from 2% to 8% east-northeast. The original topographic relief for this site ranged from about 130 feet NGVD to 230 feet NGVD.

The FL Landfill serves a population of about 9,000. The lands adjacent to the landfill are forested, except for the area adjacent to the access road which is residential. Timber operations have been reported in the forest areas adjacent to the landfill. After the access road to the landfill was constructed, about 20 residences were built on properties adjacent to the access road.

2.2 WASTE CHARACTERISTICS

From the March 1985 operating permit application, the types and volumes of wastes disposed of at this site are shown on Table II. As a special condition of the latest permit, the site is not permitted to accept significant quantities of hazardous wastes. Another special condition of the latest permit is prior to disposal of industrial wastes, the industrial concern is to provide a letter stating the nature, volume, and chemical characteristics of the wastes. To be included in this letter was a statement indicating the waste is or has been rendered innocuous or nonhazardous.

The types and volumes of wastes accepted in the past at this landfill are similar to those indicated in Table II. The total volume of wastes disposed of previously at this site was not indicated in the data file. Based on calculations in the March 1985 permit application, the total volume available in Cells 4, 6 and 7 is about 168,000 cubic yards, while the volume remaining in Cell 3 was not indicated.


N
CELL #3
CURRENTLY ACTIVE
MW5
1
2
3
4
5
6
7
MW2
STEEP GRADE
COMPLETED CELLS 1,2 & 5
MW-1
CURRENT FACE
WOODEN POST BOUNDARY MARKERS
SITE ENTRANCE SELMON ROAD
GATEMANS OFFICE
SIGN INDICATING OPERATING HOURS
EXISTING DITCH
GARAGE, STORAGE, FUEL SUPPLY OFFICE
EXISTING DEEP MW-3 (WATER SUPPLY)
FUTURE CELL AREA (NOT COVERED UNDER THIS PERMIT)
MW4
EXISTING ROAD
TEST HOLE - 1A
YARD TRASH COMPOSTING PILE
TOMATO WASTE PIT
WOOD CHIP AND FIBERBOARD OPEN STOCKPILE
SCALE: 1" = 300'

LEGEND

▲ MW SURFICIAL AQUIFER MONITOR WELL

FENCE

NOTE:

CELLS 1, 2 & 5 ARE FILLED

CELL 3 CURRENTLY ACTIVE

CELL 4 USED FOR BORROW

CELLS 6&7 PROPOSED

ELEVATIONS (MSL)

WELL #	TOP OF WELL	GROUND	FUNCTION
MW1	204.43	[illegible]	BACKGROUND
MW2	177.07	[illegible]	INTERMEDIATE
MW3	[illegible]	[illegible]	COMPLIANCE
MW4	[illegible]	[illegible]	COMPLIANCE
MW5	211.70	210.5	COMPLIANCE
TH1 A	[illegible]	[illegible]	
TH2 A	[illegible]	[illegible]	

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Water Spigot

WATER & WASTE WATER ANALYSIS
5806 HIGHWAY 22
PANAMA CITY, FLORIDA 32404
(904) 871-1900 • (904) 871-1901

LABORATORY CERTIFICATION #81148

cover

TABLE I

System Name

Address

Sample Location

Sample Type grab System I.D. 1020 M 10011

Sample Date Dec. 18, 198 Sample Time 8:50 a.m. - 10:30 a.m.

Collector

Sample Received Dec. 18, 1985 6:00 p.m. Sample Set-Up

The results of analysis are given below: Sample site

	#1	#2	#3	#4	#5
Conductivity, umhos	650	130	251	38	160
COD, mg/l	4	13	7	4	10
Total coliform #/100 ml	*1	*1	*1	13	*1
Water level	10.92'	12.84'	enclosed casing	14.88'	10.0'
Temperature	18°C	17°C	21°C	19°C	19°C
TOC, ppm	*1	3.2	*1	*1	1.3
TKN, mg/l	0.20	0.32	0.28	0.16	0.24
	*less than				

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4 19
WEST FLO

Trial Jackson

TABLE II

FL LANDFILL
TYPES, SOURCES AND QUANTITIES OF WASTE PLACED IN THE LANDFILL

	Average Waste* Received (CY/Month)	Percent
HOUSEHOLD GARBAGE		
City Collection Trucks	4,200	
County Health Department Swacars	450	
County Waste Control	90	
Experiment Station	10	
Unclassified (Cash Collections - No Detail Records Kept)	350	
	5,100	85
BOXES AND PAPER GOODS		
Hidgon Grocery	90	
IGA Grocery	120	
School Board	5	
	215	
CONSTRUCTION DEBRIS		
City	50	
Fletcher Company	100	
O.V. McPherson	30	
Solomon Contruction	40	
Peavy and Son Construction	110	
Recon Paving	5	
Shiver Construction	35	
Niagara Wire	10	
FDOT	25	
	405	7
OTHER WASTE		
Wastewater Treatment Plant Sludge	30	
Gulf Coast Hatchery - Egg Waste	60	
FL Crab Company - Crab Shells	50	
Southeast Hide Co. - Floor Sweepings containing 50% salt; also cow tails	180	
Big Bend Tires - Tires	5	
	325	5
TOTAL	**6,045**	**100**

* July 1983 through June 1984.

TABLE II

FL LANDFILL
TYPES, SOURCES AND QUANTITIES OF WASTE NOT PLACED IN THE LANDFILL

	Average Waste* Received (CY/Month)	Percent
YARD TRASH		
City	500	
Marty Ard Landscape	70	
Thad White Tree Service	25	
	595	
FURNITURE MANUFACTURERS - WOOD SCRAP		
McTavish Furniture	40	
Pat Higdon	60	
Warren Higdon	200	
	300	
TOMATO WASTE		
Beef Stake Tomato Growers	**250**	
TOTAL	**1,145**	

* July 1983 through June 1984.

2.3 DESIGN CHARACTERISTICS

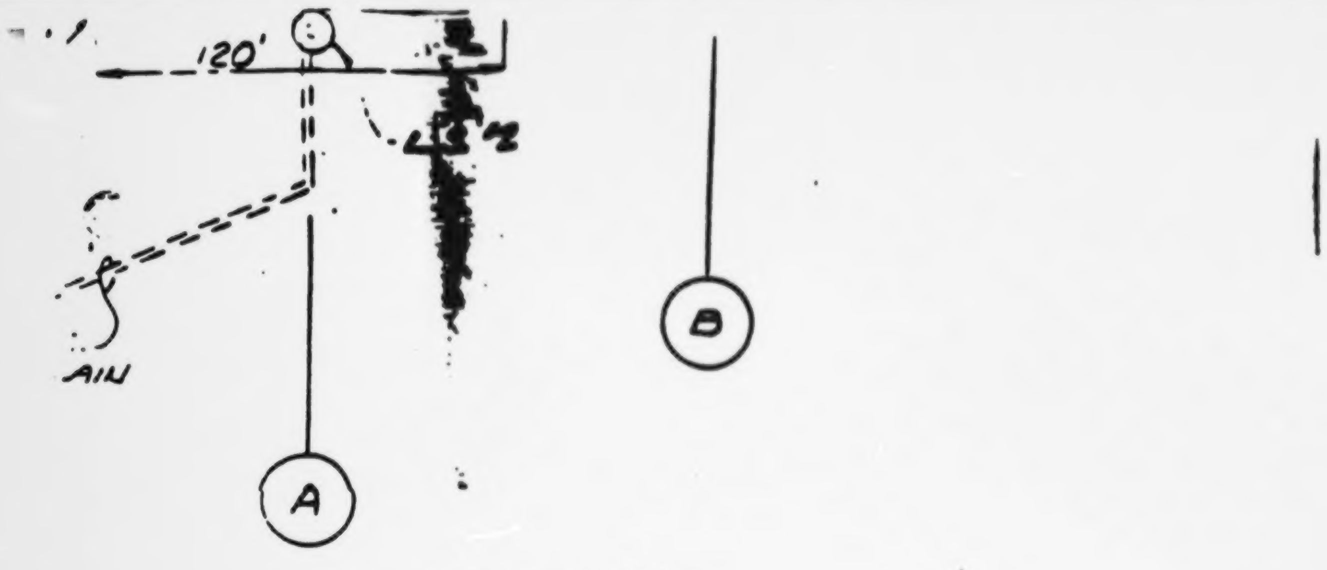
The construction permit application dated December 13, 1974 indicated the trenches were to be excavated to a depth of 10 to 30 feet below the original ground surface. The bottom of the trenches was to be graded at a slope of 1/2%. The side slopes of the trenches were not specified. Surface drainage was to be provided by 4 inch perforated pipes in sand backfilled trenches at the base of each side slope for each trench.

The wastes were to be placed in cells with a maximum working face of 40 feet in about 2 foot lifts. A 6 inch daily cover and an additional 6 inch intermediate cover over a completed cell were to be placed. The maximum settled height of a cell was to be 6 feet.

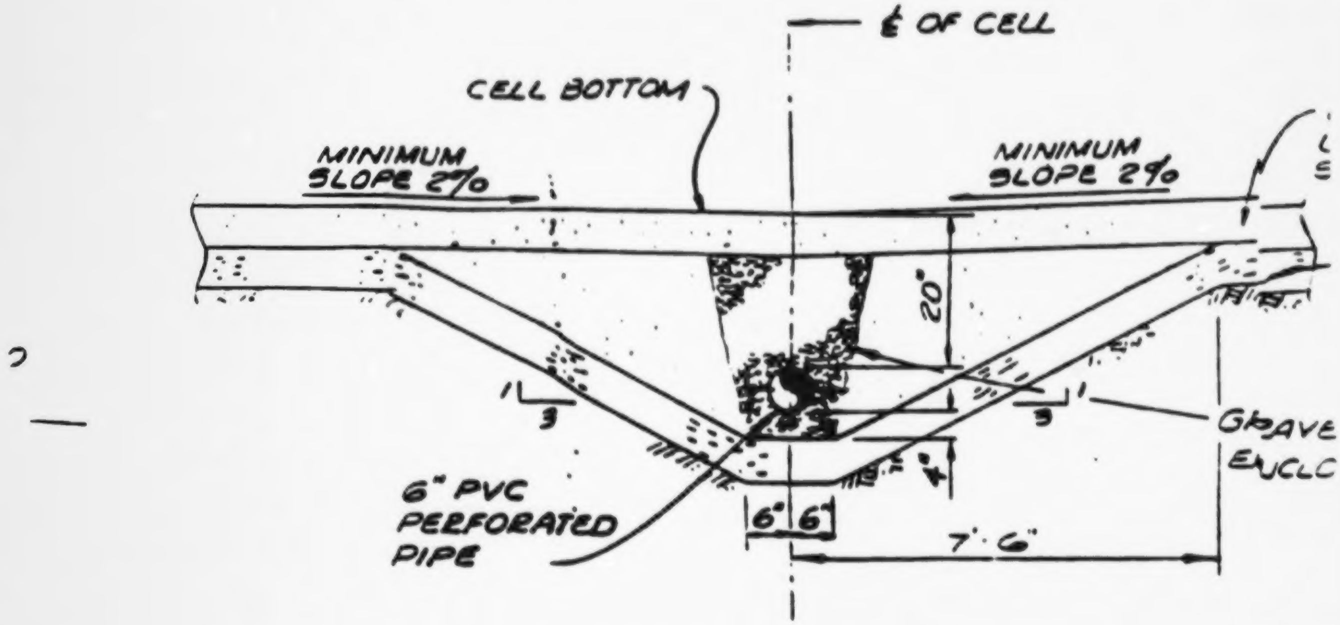
The March 1985 operating permit application indicated Cells 4, 6 and 7 were to be excavated to a depth of 20 to 30 feet, with 2 horizontal to 1 vertical side slopes. Additionally, a leachate collection system was to be installed in the unused portion of Cell 3 and in Cells 4, 6 and 7. The leachates collection system for each cell is shown on Figure 2. A bentonite-polymer soil liner was to be installed on the bottoms of Cells 4, 6 and 7, the sides of Cells 6 and 7, and as part of the final cover for Cells 1 through 7.

The individual cells within a trench were shown as 10 feet thick with a 6 inch daily and intermediate cover placed over the wastes. The method for compacting the wastes was not indicated in the copy of the permit application we were provided, although it may be included in the original or the permit application as several pages were missing in the copy we received.

The leachates collection systems were shown as a trench in each cell excavated below the base of the trench. Each of the trenches was shown lined with a 6 inch thick bentonite-polymer soil liner. After the liner is installed, a 6 inch perforated PVC pipe is shown enclosed in a gravel backfill. The gravel backfill is enclosed in filter cloth with the remainder of the trench backfilled with sand. The leachate collection systems are shown sloped to drain to one of two lift stations from which the leachates would be pumped to a leachate treatment pond. Once the leachate



PLAN - CELLS 6 & 7
SCALE: 1" = 50'


℄ OF CELL
CELL BOTTOM
MINIMUM SLOPE 2%
MINIMUM SLOPE 2%
20"
1
3
1
3
4"
6" PVC PERFORATED PIPE
6"
6"
7'-6"
GRAVE
ENCLO

TYPICAL LEACHATE COLLECTION SYSTE
SCALE 1" = 2'

FIGURE 2

WILLIAM M. BISHOP
CONSULTING ENGINEERS, INC.
OST OFFICE BOX 3407 TALLAHASSEE, FLO

was pumped to the leachate treatment pond, it would be allowed to evaporate or hauled to a sanitary treatment plant for treatment.

After placing the leachate collection system, a liner was to be placed on the bottom of the trench for Cells 4, 6 and 7, and along the sides of the trench for Cells 6 and 7. The liner was indicated to consist of 6 inches of soil mixed with a sufficient quantity of a bentonite polymer to obtain a permeability of 1 x 10^{-7} cm/sec. After the bentonite-polymer and soil are mixed, the mixture is to be compacted.

Storm water runoff was to be collected using two methods. One method was to convey runoff from the tops of cells to a detention pond using a combination of small berms and shallow ditches or swales. Another method to be used was to construct temporary berms in the bottoms of the cells in advance of the placement of wastes. These berms are to prevent uncontaminated storm water from coming into contact with the wastes or leachates.

A final cover was indicated to be placed over each completed cell and as each of the new cells is completed. The final cover was stated to consist of three 6 inch thick lifts, in addition to the 6 inch daily cover and 6 inch intermediate cover. The first 6 inches of the final cover was stated as a 6 inch loose lift of soil mixed with a sufficient quantity of a bentonite-polymer to obtain a coefficient of permeability of 1 x 10^{-7} cm/sec. The mixed material was then to be compacted. After placing the initial 6 inch lift, a 6 inch thick layer of compacted earth topped by a 6 inch layer of loose earth was to be placed.

A detail of a gas monitoring well was shown in the March 1985 permit application. Although a portion of the narrative regarding the gas monitoring well was missing from the file, it appears gas monitoring wells are to be installed if a significant quantity of gas is detected.

2.4 OPERATION AND MAINTENANCE PRACTICES

The landfill has been operating 6 days per week, 8 hours per day. The hours of operation and whether the landfill was operated on holidays were not indicated in the March 1985 permit application.

According to the March 1985 permit application, the equipment on site is a Caterpillar 955 tract loader which is used for spreading compacting, and covering wastes. The Caterpillar 955 tract loader is also used for excavation of new cells. Additional equipment provided on an as-needed basis includes a rototiller attachment, a loader/backhoe, a road grader, dump trucks, and a farm tractor and attachment for seeding and mowing grass. It was stated in the March 1985 permit application that the following equipment needed to be purchased: a tank truck, a fertilizer spreader attachment, and a steel drum compactor. It was inferred from this permit application that the following personnel were on site: an operator for the Caterpillar 955 loader, a gate keeper, a supervisor part-time, and other personnel on an as-needed basis.

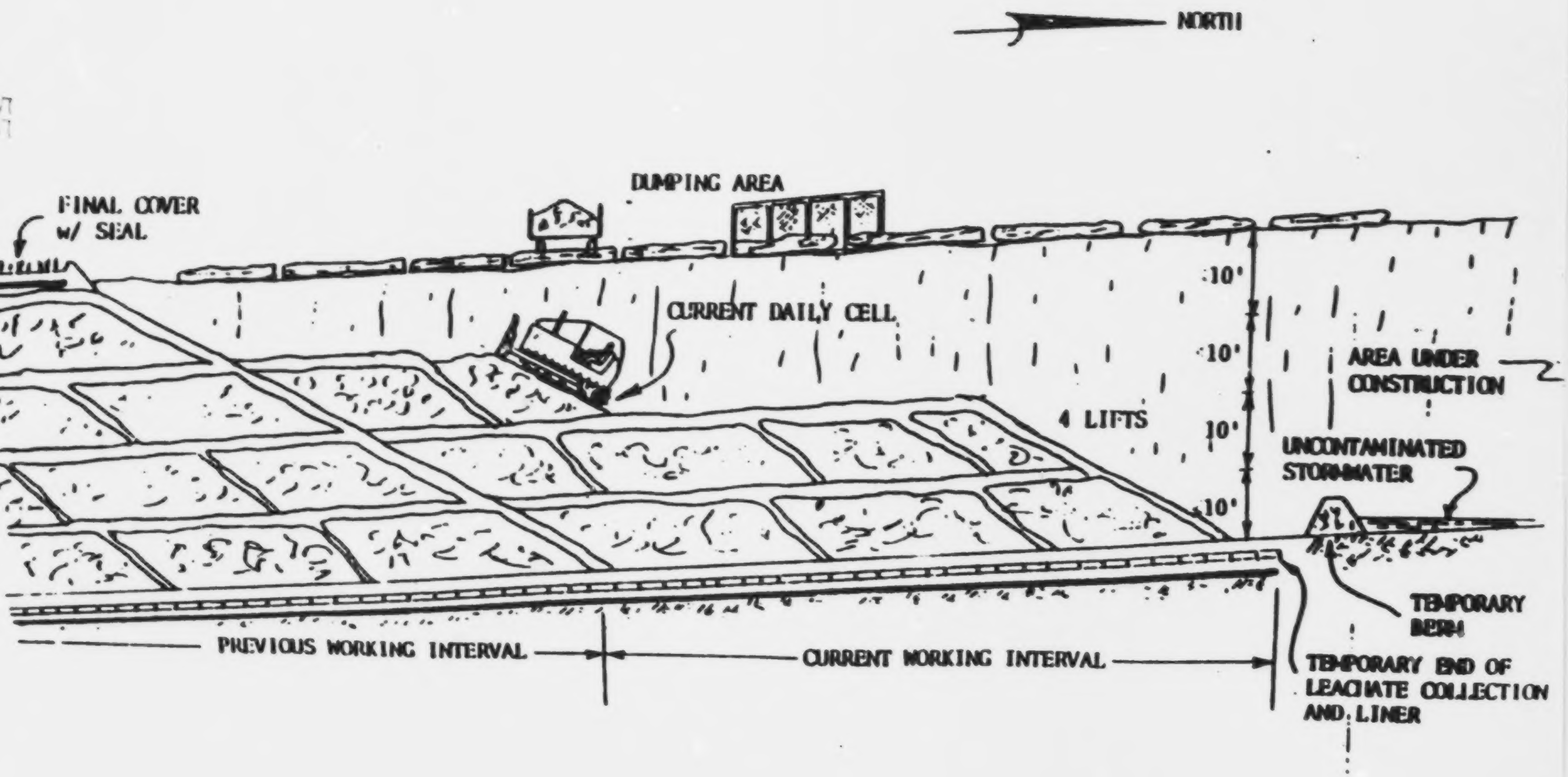
The facility utilizes the sequential trench methods for disposal of the wastes and currently has seven cells permitted. Five of the seven cells have been excavated and the excavated material used as daily and intermediate cover in the cell in which wastes were being placed. The March 1985 permit application estimated there would be excess material after the material excavated from Cells 6 and 7 was used as daily and intermediate cover for the remainder of Cell 3 and for new Cells 4, 6, and 7. The excavated material was also to be used as final cover for Cells 1 through 7.

The individual cells in a trench were shown to be constructed by spreading and compacting refuse in 10 foot lifts. The wastes are to be covered with a 6 inch layer of soil at the end of the day. The succeeding individual cells are to be placed as shown on Figure 3. An intermediate soil cover of an additional 6 inches is to be placed over the 6 inch daily cover after an individual cell is completed. A final cover of 18 inches is to be installed using the material excavated from Cells 6 and 7.

A leachate collection system is to be in the remainder of Cell No. 3 and for new Cells 4, 6 and 7. The leachate collection system is to drain to a lift station where it is to be pumped to a leachate treatment pond. From the leachate collection pond, the leachate is to be trucked to a sanitary treatment plant or allowed to evaporate.

A liner is to be placed in the bottom of Cells 4, 6 and 7, and on the sides of Cells 6 and 7. The liner is to be a bentonite-polymer soil mixture with sufficient bentonite-polymer to obtain a permeability of 1 x 10^{-7} cm/sec.

B2-14


NORTH
DUMPING AREA
FINAL COVER w/ SEAL
CURRENT DAILY CELL
10'
10'
10'
10'
4 LIFTS
AREA UNDER CONSTRUCTION
UNCONTAMINATED STORMWATER
TEMPORARY BERM
TEMPORARY END OF LEACHATE COLLECTION AND LINER
PREVIOUS WORKING INTERVAL
CURRENT WORKING INTERVAL

Dust was indicated in the March 1985 permit application to be controlled by either wetting the access road or applying an approved sesicant such as calcium chloride. Litter was indicated to be controlled by the use of portable fences and covering the site daily. The permit application indicated the County Agriculture Extension would be consulted for the proper control methods if insects become a problem. Other controls for disease and vector control were not indicated in the case file, although they may be in the original permit application as a page was missing in this section of the operation plan.

Open burning is not permitted at the landfill site. Accidental fires would be extinguished by smothering the fire with either soil or water from monitoring well MW-3. If assistance is required to extinguish a fire, the FIre Department would be called. A specific condition of the latest permit is suitable backup equipment be available for use within 24 hours in case the existing machinery should fail.

Another specific condition of the latest permit is the operator obtaining, prior to accepting industrial wastes, and keeping records on the nature, volume and chemical characteristics of the industrial waste. Included in the record is to be a statement that waste is or has been rendered innocuous or nonhazardous. Records are also to be retained of all monitoring information, copies of all reports required by the permit, and records of all data used to complete the application for the permit.

A closure plan for the FL Landfill is to be submitted at least 1 year prior to the projected date of 1992 when the proposed future cells would be filled.

3.0 ENVIRONMENTAL IMPACT

3.1 MONITORING

A groundwater monitoring program for this site was submitted in May 1984 and was approved on September 2, 1984. The groundwater monitoring plan consisted of five wells at the locations shown on Figure 1.

Monitoring well MW-1 was developed in the surficial aquifer upgradient of the landfill to provide background water quality. Monitoring wells MW-2, MW-4, and MW-5 were developed in the surficial aquifer downgradient of the landfill.

Monitoring wells MW-2 and MW-4 are intermediate wells and monitoring well MW-5 is a compliance well. Monitoring well MW-3 was developed in the Floridian aquifer and is a compliance well.

A specific condition of the latest operating permit (S020-100774) was the monitoring wells were to be sampled and tested on a quarterly basis.

Additionally, the samples were to be analyzed for the following parameters: water level (field), pH (field), conductivity (field), TDS, TOC, TNK, chlorides, iron, nitrates, sulfates, and manganese.

The 1985 permit application included a detail showing a gas monitoring well. It was not indicated in the copy of this permit application we received if gas monitoring wells were to be installed or if the gas monitoring wells were contingent upon gas being encountered.

3.2 DAMAGE ASSESSMENT

No environmental damage was reported to have been attributed to this landfill.

3.3 CORRECTIVE ACTION

While specific corrective actions were not indicated in the file, the bentonite-polymer soil mixture liner, the leachate collection system, and the leachate collection pond to be constructed could be considered as corrective actions. The bentonite-polymer soil mixture liner would reduce the generation and migration of leachate from the new cells. The bentonite-polymer soil mixture as a final cover would reduce the generation of leachate from both new and existing cells. The leachate collection system and treatment pond would collect leachate generated by the landfill and transport it so that it could be treated. The bentonite-polymer soil liner, bentonite-polymer soil mixture final cover, and the leachate collection system and treatment pond should reduce leachate generation and migration.

TABLE III

RATE OF CHARGES
FL LANDFILL

Type of Vehicle	Charge
2-Wheel Trailer	$ 1.50
Pick-Up Trucks	1.50
1-Ton Trucks	3.00
1.5-Ton Trucks	4.00
2-Ton Trucks	5.00
Small Dump Trucks	5.00
4-Wheel Trailer	6.00
Swacar-Type Trailer	6.00
Tractor-Trailer	8.00 - 10.00
16-24 CY Garbage Compactors	10.00
25-32 CY Garbage Compactors	14.00
Large Dump Trucks	10.00
Large Dump Trailer	20.00

4.0 COST DATA

Cost data included in the 1985 permit application included the charges for different types of vehicles and are presented in Table III. The time period for these charges is not known.

CASE STUDY

SM LANDFILL

by

ICF Northwest
Hapo Building, 4th Floor
601 Williams Boulevard
Richland, WA 99352

Contract No. 68-01-7290
Work Assignment No. 25

Project Officer
Ronald McHugh

Work Assignment Manager
Jim Pittman

U.S. ENVIRONMENTAL PROTECTION AGENCY
401 M STREET, S.W.
WASHINGTON, D.C. 20460

August 1986

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SUMMARY FACT SHEET

Key elements of this case study include the following:

- A permit to construct and operate the 58 acre landfill was issued in 1976.
- The site receives approximately 1.5×10^6 yd^3/year of municipal solid wastes from commercial waste haulers.
- The topography at the site includes both a flood plain and adjacent uplands.
- Various materials underlie the site including clay, mudstone, sandstone, and volcanic rocks. Active disposal areas are generally underlain by low-permeability clays and mudstone. No engineered liners are required.
- The facility is operated using both the trench- and area-fill methods of disposal. The bottom of trench excavations must be at least 3 feet above the seasonal high groundwater table.
- The depth of groundwater at the site is generally shallow, ranging from 5 to 12 feet.
- Landfill operation includes collection of leachate with treatment by spray irrigation at the site during the summer months.
- The original leachate storage lagoon had a capacity of 6.9×10^6 gallons, which was inadequate for storage during the winter months. An additional 25.7×10^6 gallon lagoon was constructed in 1983.
- Groundwater monitoring appears to indicate elevated levels of some contaminants when compared to the background well. No surface water contamination has been detected.

1.0 ESTABLISHMENT IDENTIFICATION

The SM Landfill was constructed to serve as a central landfill as part of the county's regional solid waste management program. A permit application for the site was issued in December 1976.

The site had been used as an automobile raceway. The site topography is ranging from flat to moderately sloped. Land use around the site is apparently agricultural with a low population density.

The site is underlain by several different materials including clay, mudstone, and basalt. Most of the site where disposal occurs is underlain by low-permeability material. During wet winter months, water may be ponded on the ground surface. Depth to groundwater varies seasonally.

Wastes received by the site are municipal wastes hauled by commercial haulers. The public is not allowed to use the site. Municipal sewage sludge is apparently also disposed of at the site.

Wastes are disposed of using the trench- area-fill methods of disposal. An important design feature of the site is a leachate collection and treatment system. Leachate is collected in a lagoon at the site and treated by land application. The leachate lagoon was recently expended to increase its storage capacity. The site has reportedly has some operational problems related to odor control.

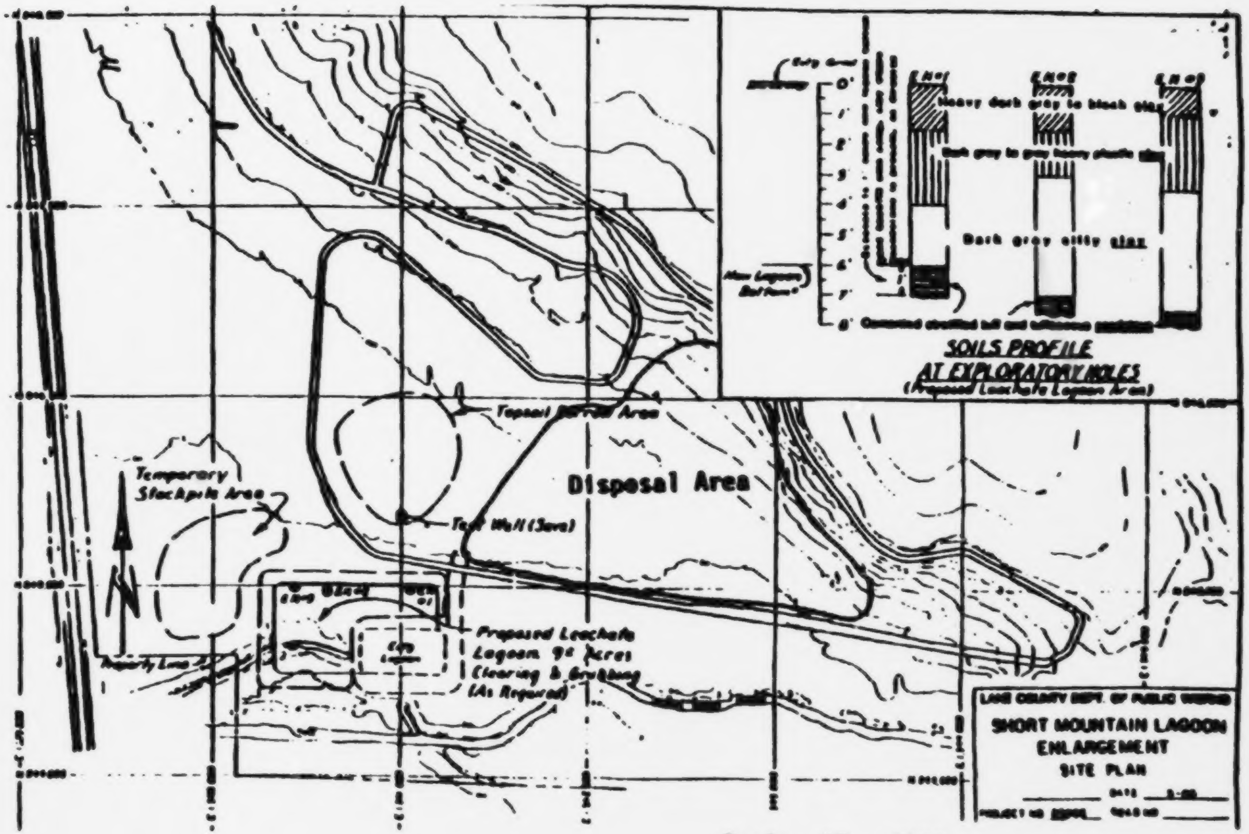
2.0 DETAILED ESTABLISHMENT DESCRIPTION

2.1 GENERAL

The SM Landfill was established in 1975-1976. The 58 acre landfill is owned and operated by the county and accepts waste only from commercial haulers. The facility is located on a 580-acre parcel of land. An inspection conducted in 1983 indicated that approximately 2 to 3 acres of fill had received final cover.

The site topography ranges from flat to moderately sloped. The southwestern portion of the site is generally flat, being located in the flood plain. The topography then rises to the northeast. A topographic map of the site is shown in Figure 1. There is approximately 500 feet of relief at the site with elevations ranging from 500 to 1,000 feet. The land use and population distribution around the site were not described in the file information.

The site is underlain by four major materials: clay, mudstone, sandstone, and volcanic rock. The clay underlies the lower, southwestern portion of the site and is generally found below an elevation of 520 feet. This soil is derived from the weathering of the mudstone of the Eugene Formation and is generally described as moist, gray-black, very stiff, slightly sandy clay. The thickness of this soil is typically greater than 8 feet. Mudstone is generally found in the central portion of the site at elevations between 530 and 700 feet. The rock is fresh to moderately weathered and is generally described as moist gray, brown, or gray-brown mottled, widely jointed mudstone with rust staining on jointing and bedding planes. Sandstones at the site are sedimentary sandstones and conglomeratic sandstones of the Eugene Formation. These materials are interbedded with the mudstones and occur in the northwest part of the site in a bed at an elevation of 550 to 600 feet. Where exposed , the sandstone is deeply weathered to a friable reddish-buff color. The rock is generally described as arkosic, tuffaceous, volcanic-derived from weathered volcanic rocks. Volcanic rock at the site consists of basalt and andesite flows and dike intrusives with little soil cover. These rocks are generally confined to the upper east and northeast portions of the site.


Temporary Stockpile Area
Property Line
Topsoil Borrow Area
Test Well (3ea)
Disposal Area
Proposed Leachate Lagoon 9± Acres Clearing & Grubbing (As Required)
Heavy dark gray to black clay
Dark gray to gray heavy plastic clay
Dark gray silty clay
Max Lagoon Bottom
0'
1'
2'
3'
4'
5'
6'
7'
8'
SOILS PROFILE AT EXPLORATORY HOLES
(Proposed Leachate Lagoon Area)
LANE COUNTY DEPT. OF PUBLIC WORKS
SHORT MOUNTAIN LAGOON ENLARGEMENT
SITE PLAN
DATE
PROJECT NO

Scale: 1" = 900'

Reproduced from best available copy.

Figure 1. Topography at the SM Sanitary Landfill

The above materials were generally considered to be suitable for development of a sanitary landfill. While permeability tests were not performed, the clays were described as being nearly impermeable at or near optimum moisture content.

Groundwater at the site was not well characterized or described in the site investigation report. It was mentioned that during winter months, the groundwater may actually rise to the ground surface. It was not certain, however, if this condition was caused by rising groundwater or by surface water ponding due to poor soil drainage. Depths to groundwater in monitoring wells ranged from 6.0 to 11.8 feet as measured in April 1985. Uses of groundwater near the site were not described.

Surface water drainage at the site is generally to the south.

2.2 WASTE CHARACTERISTICS

The facility file contained very little information on the types and amounts of wastes received. The only information given was that the site receives wastes only from commercial haulers and that the public is not allowed to use the site. The SM Landfill received a total of 1,444,626 yd^3 of solid wastes in 1983 and 1,512,006 yd^3 in 1984.

Although hazardous waste disposal is not allowed at the site, the facility file indicates that hazardous wastes have been stored at the site. Correspondence dated April 1985, indicates that an accumulation of PCB capacitors and transformers were in temporary storage at the site. The final disposition of those materials was not specified.

Information in the facility file also describes the disposal of sewage sludge at the site by land application. It is not clear from the information presented whether the site is routinely used for disposal of sewage sludge or if sludge is applied only to aid in revegetation of final cover. The site reportedly received a total of 128,200 gallons of sludge in 1983 and 240,855 gallons in 1984.

2.3 DESIGN CHARACTERISTICS

From the information presented in the facility file, it does not appear that synthetic or engineered liners are required at the site. The only reference to liners is contained in the general conditions of the permit. These conditions require that the deepest landfill excavation be a minimum of 3 feet above the seasonal high groundwater table. An inspection conducted in April 1983, indicated that wastes were being placed in cells directly on top of the existing ground surface.

Surface runon and runoff are controlled through the use of diversion ditches and berms. Temporary berms are used to route all potentially contaminated runoff from active disposal areas to the leachate storage lagoon. Runon from uncontaminated areas is diverted around active disposal areas. No other details of the surface runoff control system were provided.

Leachate collection is an important aspect of the facility design. The facility permit requires that all leachate and contaminated rain and surface water must be stored through the period from November 1 through May 1 of each year without discharge. From May 1 through November 1, stored leachate is disposed of by irrigating on adjacent land.

The leachate collection system for the site consists of an interceptor trench located downgradient (south) of the disposal area. Leachate flows by gravity through this trench to a wet well/pump station where it is pumped to the storage lagoon. Specific design details of the system were not available in the facility file. The storage lagoon originally constructed at the site consisted of a 2.4 acre lagoon having a volume of 6,930,000 gallons. This lagoon did not prove large enough to store leachate during the winter months. Therefore, in 1983 the construction of an additional 25,667,000 gallon, "L" shaped lagoon around the existing facility began. The combined capacity is great enough that irrigation is required only during the summer months. Both lagoons are constructed above grade with dikes made of compacted clay soil. The lagoon bottoms are lined with 1 foot of compacted clay soil.

A site inspection report prepared in 1983 indicated that methane control systems are present at the site. No details were provided on these systems.

2.4 OPERATION AND MANAGEMENT PRACTICES

No data were available in the facility file on the number of employees present, hours worked, or equipment used on site. The site is operated using a combination of the area-fill and trench-fill methods of disposal. Clay topsoil is excavated from the southwestern part of the site for use as daily and final cover. The facility permit requires daily cover consisting of at least 6 inches of compacted soil and final cover consisting of at least 2 feet of compacted soil. Originally, wood chips were used as daily cover. This practice was stopped because of odor problems. Revegetation of the final cover is apparently enhanced by the application of sewage sludge.

Some operational problems have been encountered in the past with operation of the leachate collection/treatment system. These problems were apparently related to the size of the collection/treatment system. As described above, the lagoon was recently expanded to contain increased leachate flow. The leachate flow measured in 1983 was 8,250,000 gallons. Estimated flows for 1984 and 1989 were 8,500,000 and 12,500,000 gallons, respectively. The irrigation system was also expanded to correct leachate runoff problems encountered in the past.

3.0 ENVIRONMENTAL IMPACT

3.1 MONITORING

Groundwater monitoring is a requirement of the facility operating permit. The permit requires that groundwater monitoring wells be installed in accordance with specified recommendations. Biannual monitoring must be conducted for pH, alkalinity, conductivity, chemical oxygen demand (COD), ammonia nitrogen, chloride, and nitrate nitrogen. In 1983, six wells were constructed at the site at the locations shown in Figure 2. Typical well completion details are shown in Figure 3. The logs of these wells were not available. The completed well depths and depths to groundwater in April 1985, are shown in Table 1. Monitoring data are available for April 1984; October 1984; and April 1985. Analytes include the required parameters plus temperature, sulfate, color, iron, calcium, magnesium, hardness, and total organic carbon (TOC). The most recently available results (April 1985, sampling) are shown in Table 2.

Surface water and leachate sampling are also required at the site. Three surface water sampling stations and one leachate sampling station are maintained, as shown in Figure 2. Since 1984, these stations have been sampled at the same time and for the same analytes as the monitoring wells. Prior to 1984, the leachate lagoon and Camas Swale Creek were occasionally sampled. The most recently available results (April 1985, sampling) are shown in Table 3.

3.2 DAMAGE ASSESSMENT

No documentation of environmental damage was presented in the site file information. The groundwater monitoring data presented in Table 2 indicate several parameters in downgradient wells elevated above levels in the background well (GW-1). The most notable of these are the organic parameters, COD and TOC, which are high in well GW-6. The impact of landfill operations on these levels is not specifically known because there are no comparative background data collected before disposal began. The environmental impact of elevated levels is not known because the use of shallow groundwater in the area is not described. Because of the

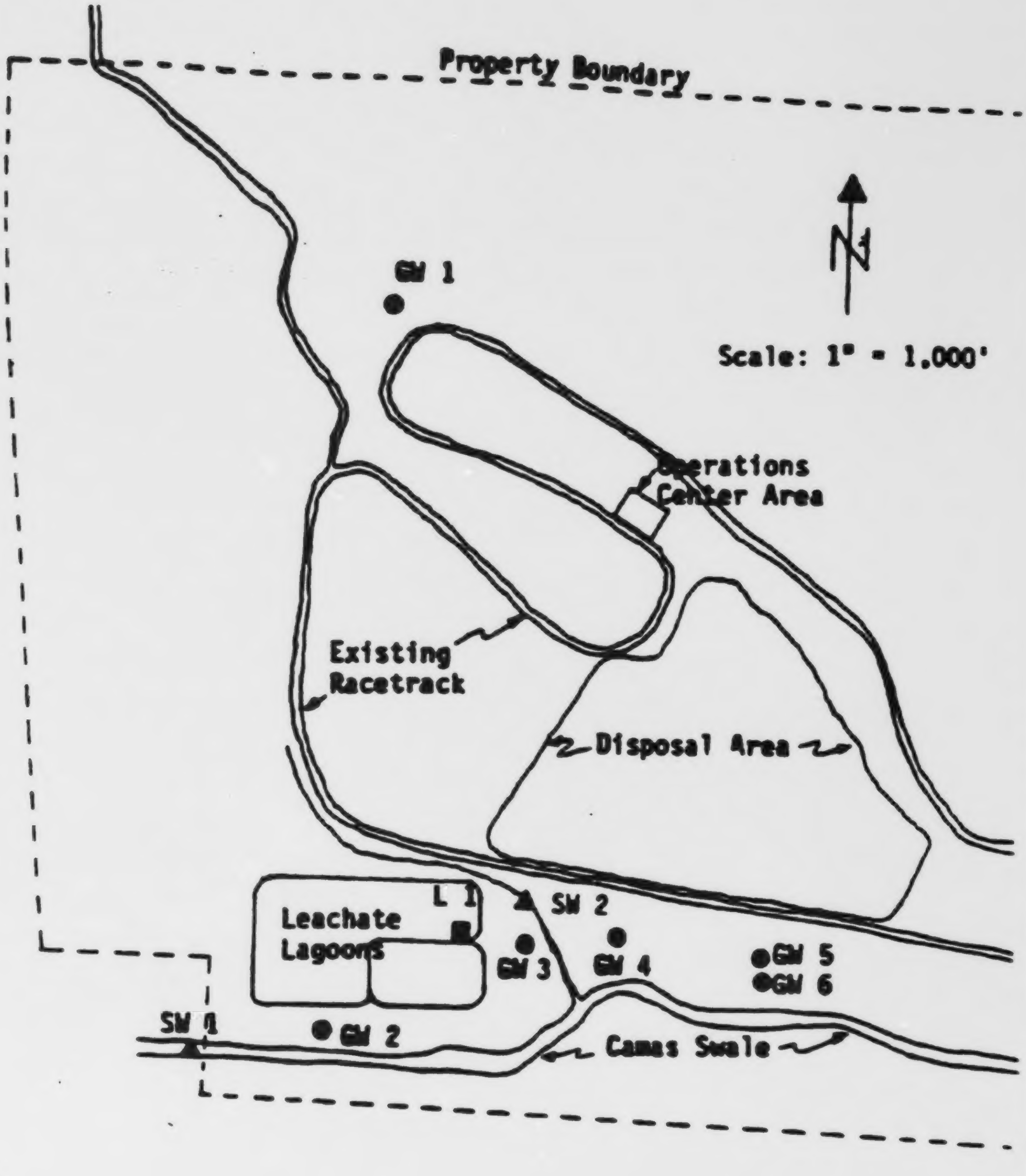

Property Boundary
GW 1
Scale: 1" = 1,000'
Operations Center Area
Existing Racetrack
Disposal Area
Leachate Lagoons
L 1
SW 2
GW 3
GW 4
GW 5
GW 6
SW 1
GW 2
Camas Swale

Figure 2. Location of Monitoring Stations.

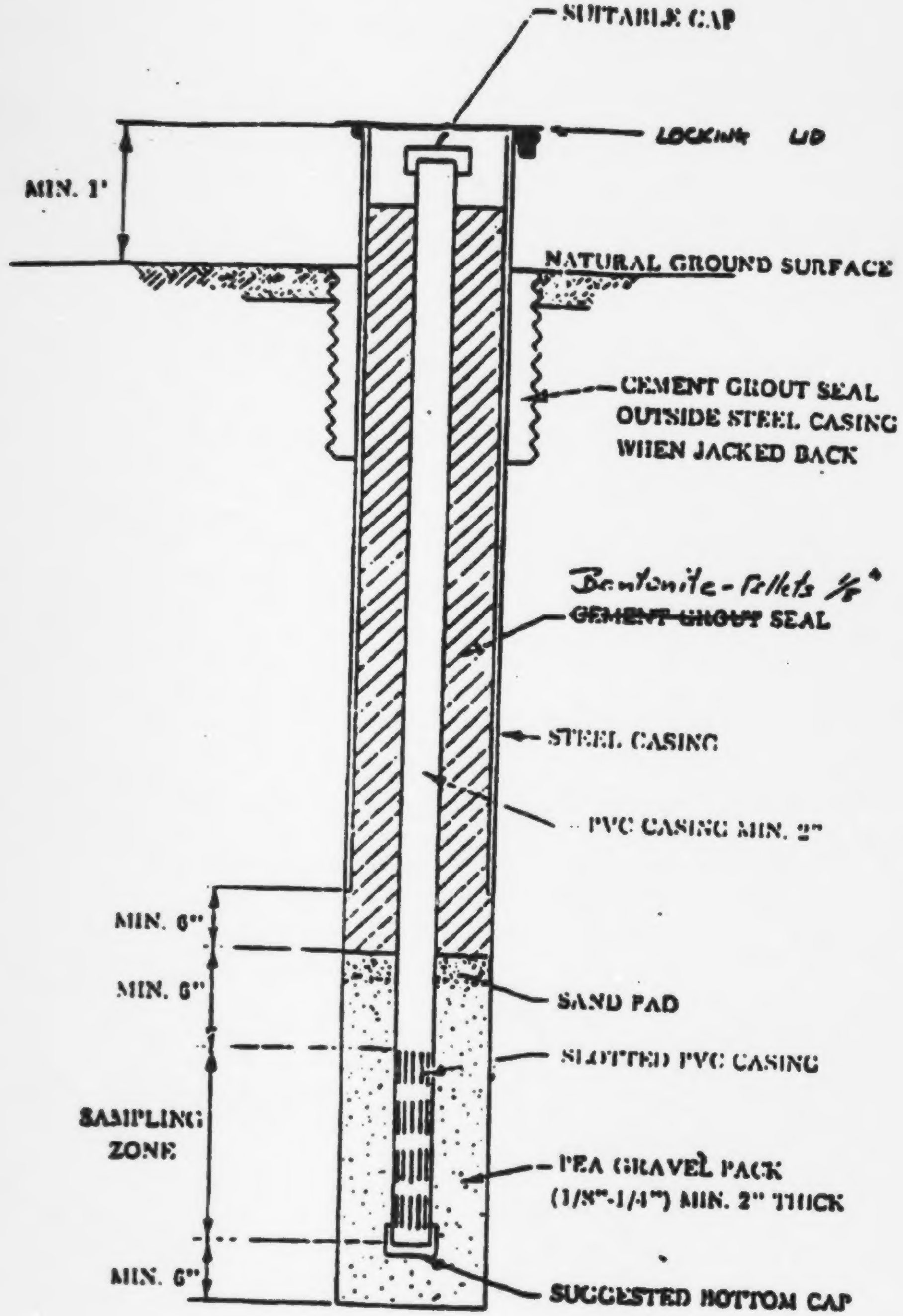

SUITABLE CAP
LOCKING LID
MIN. 1'
NATURAL GROUND SURFACE
CEMENT GROUT SEAL OUTSIDE STEEL CASING WHEN JACKED BACK
Bentonite-Pellets 1/8"
~~CEMENT GROUT~~ SEAL
STEEL CASING
PVC CASING MIN. 2"
MIN. 6"
MIN. 6"
SAND PAD
SLOTTED PVC CASING
SAMPLING ZONE
PEA GRAVEL PACK (1/8"-1/4") MIN. 2" THICK
MIN. 6"
SUGGESTED BOTTOM CAP

Figure 3, Typical Monitoring Well Construction Details.

low permeability of the shallow aquifer, use of shallow groundwater is likely to be minimal.

The surface water monitoring data shown in Table 3 shows essentially no difference between samples taken from the Creek upstream and downstream of the site. These results are suggestive of minimal impact of landfill operations on surface water quality.

3.3 CORRECTIVE ACTIONS

No corrective action at the site have been required other than the expansion and improvement of the leachate collection and treatment system.

TABLE 1

SUMMARY OF MONITORING WELL DEPTHS AT SM SANITARY LANDFILL

Well No.	Location	Well Depth, Feet	Depth To Water, Feet April, 1985
GW-1	North of Access Road (Background)	31.2	11.2
GW-2	Southwest of Lagoon	16.5	6.8
GW-3	Immediately East of Lagoon	13.8	4.9
GW-4	East of Lagoon; South of Fill	14.0	6.1
GW-5	South of Fill	15.9	5.9
GW-6	South of Fill; Near GW-5	33.8	9.6

TABLE 2

SUMMARY OF GROUNDWATER MONITORING RESULTS FROM SM SANITARY LANDFILL APRIL, 1985

Parameter	Monitoring Well					
	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6
Temperature, °C	13	13	12	12	12	13
Conductivity, µmhos/cm	479	3,818	5,972	2,470	959	2,638
pH	7.5	6.3	6.8	6.9	7.5	7.3
NH_3-N, mg/l as N	0.03	<0.02	0.03	0.03	0.02	0.12
NO_3 + NO_2-N, mg/l as N	1.7	0.09	1.1	0.02	0.09	0.03
Alkalinity, mg/l as $CaCO_3$	237	66	129	175	165	218
Chloride, mg/l	18	1,100	2,000	630	190	720
Sulfate, mg/l	2.8	330	270	59	8.2	23
Color, Pt-Co Units	<5	<5	<5	<5	15	<5
Iron, mg/l	<0.05	0.05	0.08	<0.05	0.07	<0.05
Calcium, mg/l	36	350	560	150	29	120
Magnesium, mg/l	94	140	110	54	10	142
Hardness, mg/l	130	500	1,900	600	110	420
COD, mg/l	<5	31	15	60	9	775
TOC, mg/l	<1	9	5	20	9	300

TABLE 3

SUMMARY OF SURFACE WATER AND LEACHATE MONITORING RESULTS FROM SM SANITARY LANDFILL APRIL, 1985

Parameter	Monitoring Well			
	SW-1	SW-2	SW-3	L-1
Temperature, °C	14.5	*	17.0	16.5
Conductivity, µmhos/cm	133	*	153	3,068
pH	7.2	*	7.3	8.7
NH_3-N, mg/l as N	0.49	*	0.72	44
NO_3 + NO_2-N, mg/l as N	0.59	*	1.4	0.04
Alkalinity, mg/l as $CaCO_3$	45	*	51	884
Chloride, mg/l	11	*	14	480
Sulfate, mg/l	1.9	*	2.2	6.4
Color, Pt-Co Units	60	*	50	400
Iron, mg/l	0.14	*	0.12	0.20
Calcium, mg/l	11	*	11	62
Magnesium, mg/l	3.6	*	4.1	63
Hardness, mg/l	42	*	44	410
COD, mg/l	8	*	<5	245
TOC, mg/l	3	*	4	108

* Not Sampled

4.0 COST DATA

No cost data were available for this site.

CASE STUDY

PC LANDFILL

by

ICF Northwest
Hapo Building, 4th Floor
601 Williams Boulevard
Richland, WA 99352

Contract No. 68-01-7290
Work Assignment No. 25

Work Assignment Manager

Jim Pittman

U.S. ENVIRONMENTAL PROTECTION AGENCY
401 M STREET, S.W.
WASHINGTON, D.C. 20460

June 1986

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SUMMARY FACT SHEET

Key elements of this case study include the following:

- Construction of the PC site was approved in December, 1982.
- The facility is designed as a containment/collection landfill with a clay liner and leachate collection system.
- The land fill occupies 18.6 acres and will be developed in 4 phases with an estimated life of 15 years and a capacity of approximately 1,200,000 yd^3 of refuse.
- The site receives approximately 80,000 yd^3/yr of residential/commercial solid waste generated in PC.
- The surrounding land use varies from rural agricultural to rural residential to residential.
- The topography is rolling with depressions, typical of glacial end-moraine.
- The site is underlain by thick deposits of glacially-derived, unconsolidated material consisting primarily of sandy till. These deposits generally exhibit relatively high permeabilities.
- Because of the permeable on-site soils, clay for constructing liners must be imported from off-site.
- The depth to groundwater at the site varies from 40 to 160 feet depending on topography.
- Routine monitoring is done on a quarterly basis. No environmental damage has been documented.

1.0 ESTABLISHMENT IDENTIFICATION

The PC Landfill is a relatively new facility. A permit for operation of the site was issued in December 1982.

The site is characterized topographically by rolling hills with numerous kettle depressions. Surrounding land use varies from rural agricultural to rural residential residential. Future land use for the area was not specified in the facility file.

The site is located on deep deposits of glacially-derived, unconsolidated sediments consisting predominantly of sandy, glacial till. The depth to groundwater ranges from 40 to 160 feet, depending upon site topography. No navigable surface waters are located on the property; however, some of the surface water runoff collects locally in kettle holes or infiltrates directly into the subsurface. The site primarily receives municipal/commercial solid waste. Approximately 80,000 yd^3 of waste are disposed of at the site yearly. The facility occupies 18.6 acres and has an estimated life of 15 years.

The landfill is designed as a clay lined containment/collection site. The site design includes a 5-foot thick clay liner a and a leachate collection system. The site will be developed in 4 phases using the area fill method of disposal.

2.0 DETAILED ESTABLISHMENT DESCRIPTION

2.1 GENERAL

The PC Landfill is located on 80 acres of land. The facility operating plan was approved in April, 1982, and construction approved and a permit issued in December, 1982.

The site is characterized topographically by rolling hills with numerous kettle depressions (Figure 1). The general slope of the land is to the east-southeast. Ground elevations at the disposal site range from 1,244 feet in the northwest corner to 1,168 feet in the northeast.

Land use surrounding the site varies from rural agriculture to rural residential to residential. The population immediately surrounding the site was not specified in the facility file.

The unconsolidated deposits at the site consist mainly of sandy glacial till. The site is mantled in most places by a thin veneer of topsoil ranging from 0 to 1 foot in thickness. The texture of the topsoil is a silty sand. The sandy till deposits are directly under the topsoil and have been divided into three groups based on grain-size analyses. A brown fine sand, little to some silt and clay, little gravel is the upper sand unit over the majority of the site. The fine sand unit ranges in thickness from 0 to over 100 feet. The soil gradations range from 5-15 percent gravel, 3-8 percent coarse sand, 20-27 percent medium sand, 41-59 percent find sand, and 8-15 percent silt and clay. Generally underlying the fine sand is a brown, fine to medium sand, some gravel, little silt and clay. The unit varies in thickness from 0 to over 140 feet. The gradations range from 15-26 percent gravel, 5-12 percent coarse sand, 19-41 percent medium sand, 28-51 percent fine sand, and 6-10 percent silt and clay. This unit is somewhat coarser than the upper fine sand. Underlying the fine to medium sand is a brown fine to coarse sand, little silt and clay, trace to some gravel. The gradations for this unit range from 2 to 40 percent gravel, 13-33 percent coarse and, 22-31 percent medium sand, 11-29 percent fine and 6-8 percent silt and clay. Approximations of the permeability (based on grain-size analyses) indicate the

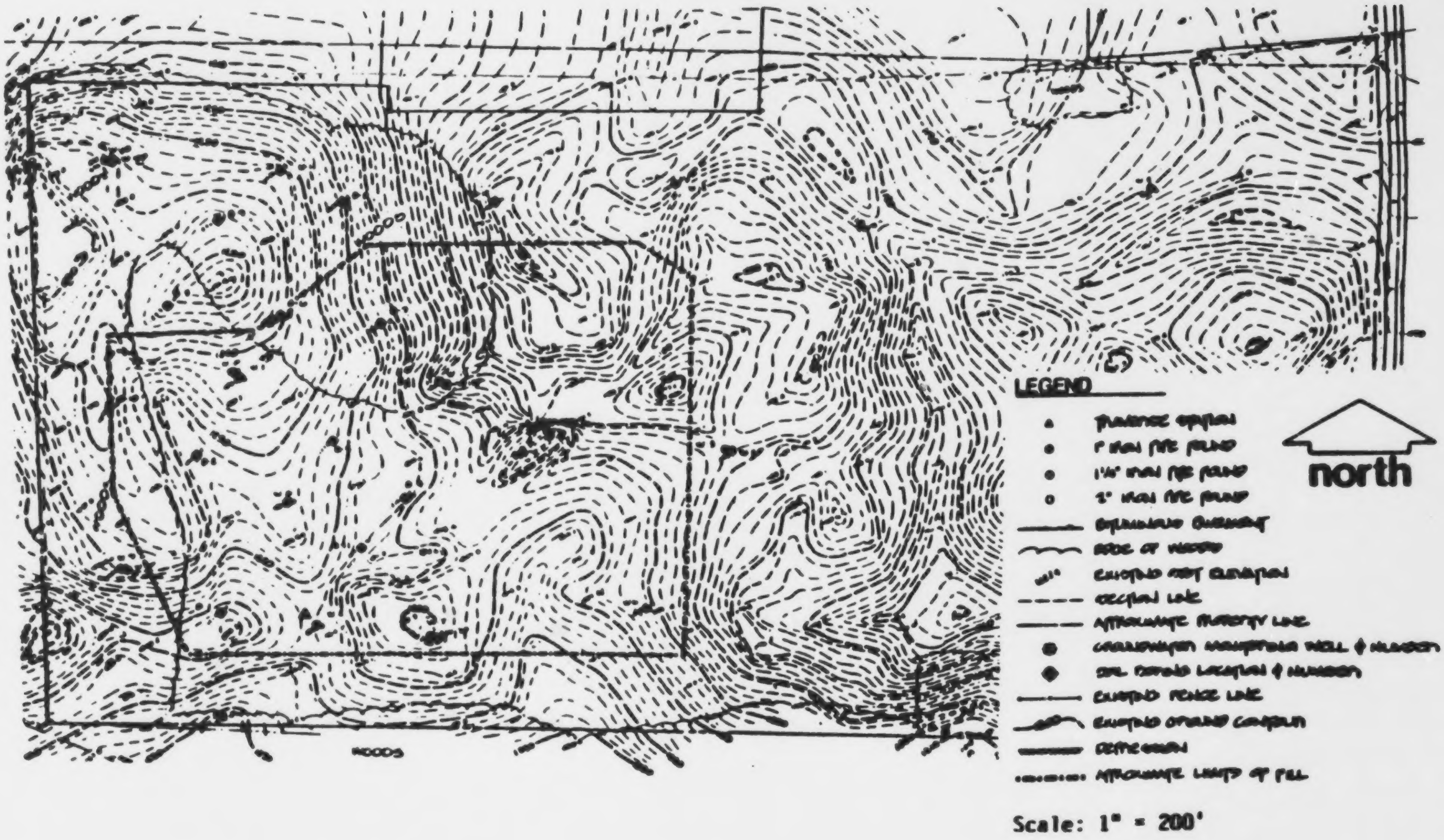

LEGEND
TRAVERSE STATION
1" IRON PIPE FOUND
1¼" IRON PIPE FOUND
2" IRON PIPE FOUND
EDGE OF WOODS
EXISTING SPOT ELEVATION
SECTION LINE
APPROXIMATE PROPERTY LINE
GROUNDWATER MONITORING WELL & NUMBER
SOIL BORING LOCATION & NUMBER
EXISTING FENCE LINE
EXISTING GROUND CONTOUR
APPROXIMATE LIMITS OF FILL
north
WOODS
Scale: 1" = 200'

Figure 2. Existing Topography at the PC Sanitary Landfill.

permeability to be in the range of 7×10^{-3} cm/sec to 4×10^{-2} cm/sec. The percent of silt and clay in the sandy soils appears to be the controlling factor on the permeability of the soils.

Bedrock was not encountered in any of the soil borings at the site (which ranged up to 110 feet in depth). The glacial drift deposits of northern PC are underlain by Precambrian aged igneous and metamorphic rocks. The rocks are generally impermeable, consisting largely of granite. Gneiss, schist, shale, greenstone, and quartzite do occur, however, in outcrops in the northern parts of the County. The surface of the Precambrian basement is generally flat, slopping to the south at approximately 10 feet per mile.

The depth to groundwater at the site ranges between 40 and 160 feet. The glacial drift is the major water bearing aquifer in the site vicinity. Areas of clean sand and gravel outwash can yield up to 2,000 gpm, whereas the most productive wells in the glacial till yield less than 1,000 gpm and typically less than 500 gpm.

Regional data indicate the presence of a regional groundwater divide to the west of the site as shown in Figure 2. The divide is rather broad in the vicinity of the site. Flow directions are generally to the south-southeast through the site area.

Recharge to the aquifer is predominantly from infiltration of precipitation. Due to the high permeability sands, large volumes of precipitation infiltrate into the subsurface soils. Many of the kettle depressions in the morainal areas collect local surface wter runoff and act as local infiltration basins replenishing groundwater supplies.

Groundwater discharges generally occurs along lakes, rivers, and wetlands. The closest discharge areas to the site are wetland areas to the southeast. A major discharge area for groundwater flowing beneath the site appears to be the Tomorrow River, located several miles to the east.

The closest well to the landfill site is approximately 1,400 feet to the north (upgradient). The closest downgradient well is approximately 1,800 feet to the southeast. Although high capacity irrigation wells are common in the area, there are none in the immediate vacinity of the site due to the irregular topography (i.e., the topography does not allow use of large center pivot irrigation systems). Available information indicates the nearest high capacity well is 3/4 of a mile southwest of the site. The next nearest high capacity well is 2 miles northwest of the site. Neither will is expected to affect groundwater flow at the site or to be affected by the site.

The only on-site surface waters are the areas of ponded waters within the kettle depressions. Several small wetlands occur to the east of the site area.

2.2 WASTE CHARACTERISTICS

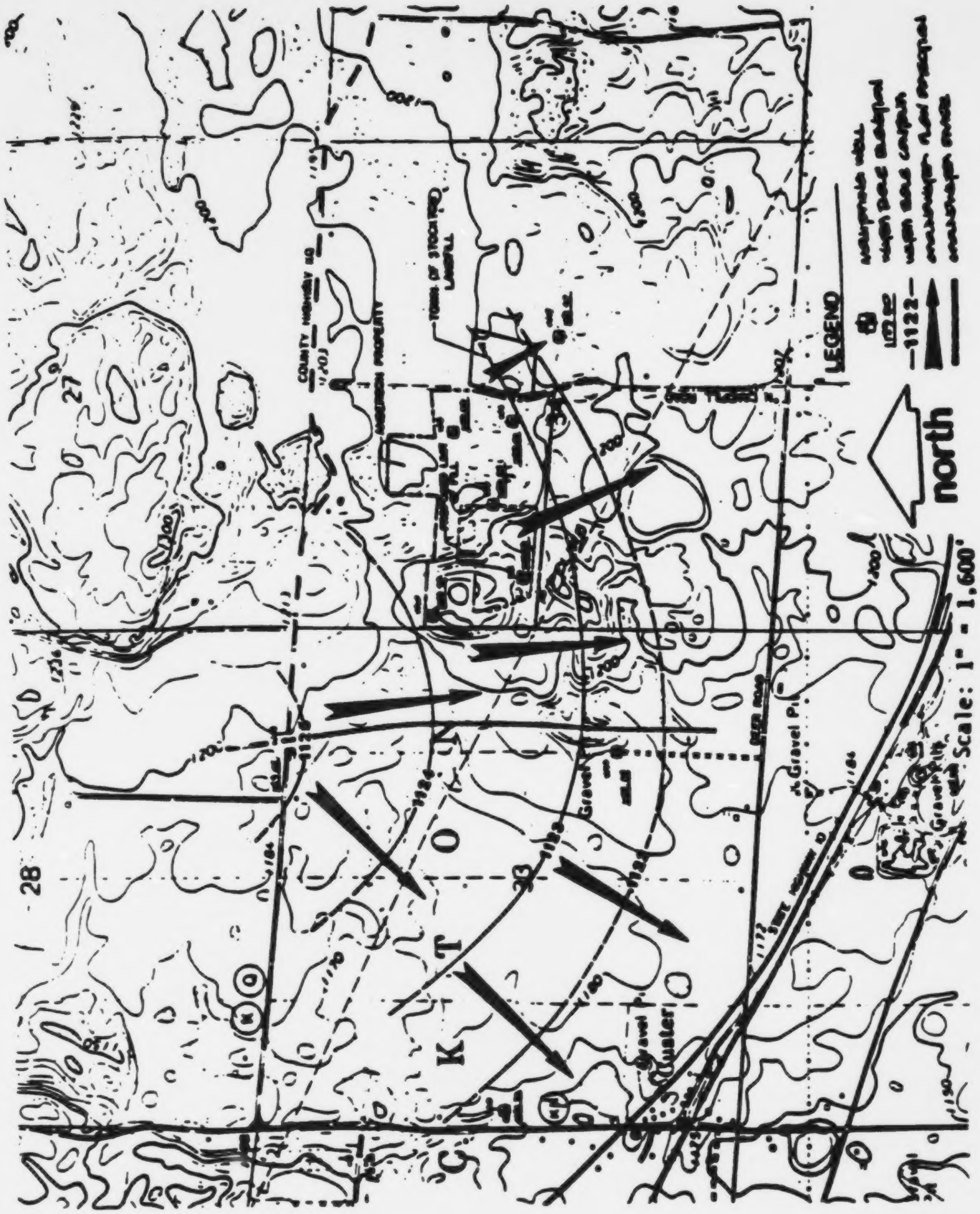
The PC Landfill is permitted to receive municipal/commercial solid wastes. These wastes include, but are not limited to, garbage, refuse, wood matter, and demolition waste. The quantity of waste received at the site is approximately 80,000 yd^3/yr. The site has an approximate 15-year life, with a total refuse capacity of approximately 1,200,000 yd^3. The quantity of wastes presently in place was not specified.

The site receives no liquid wastes or hazardous wastes.

2.3 DESIGN CHARACTERISTICS

Because of the thick deposits of highly permeable sands, a 5-foot clay liner with a leachate collection system was required. Clay used for constructing the liner is obtained from an off-site source. The clay soil is required to have at least 50 percent material finer than a No. 200 sieve, at least 25 percent clay content, a liquid limit of 30 percent or greater, a plasticity index of 15 percent or greater, and a permeability of less than 10^{-7} cm/sec. The liner is sloped a 2.5 percent toward leachate collection pipes. For protection and to improve leachate drainage, the liner is covered with a 1-ft thick drainage blanket consisting of granular material having a permeability greater than 10^{-3} cm/sec.

The leachate collection system consists of a network of 6-in. diameter perforated PVC pipes which drain to a central leachate collection point. Collection pipes are installed in trenches backfilled with coarse gravel. The layout of the leachate collection system is shown in Figure 3. The average leachate flow distance is


LEGEND
—1122—
north
Scale: 1" = 1,600'
27
28
33
K
O
T
Gravel Pit
Gravel Pit
Gravel

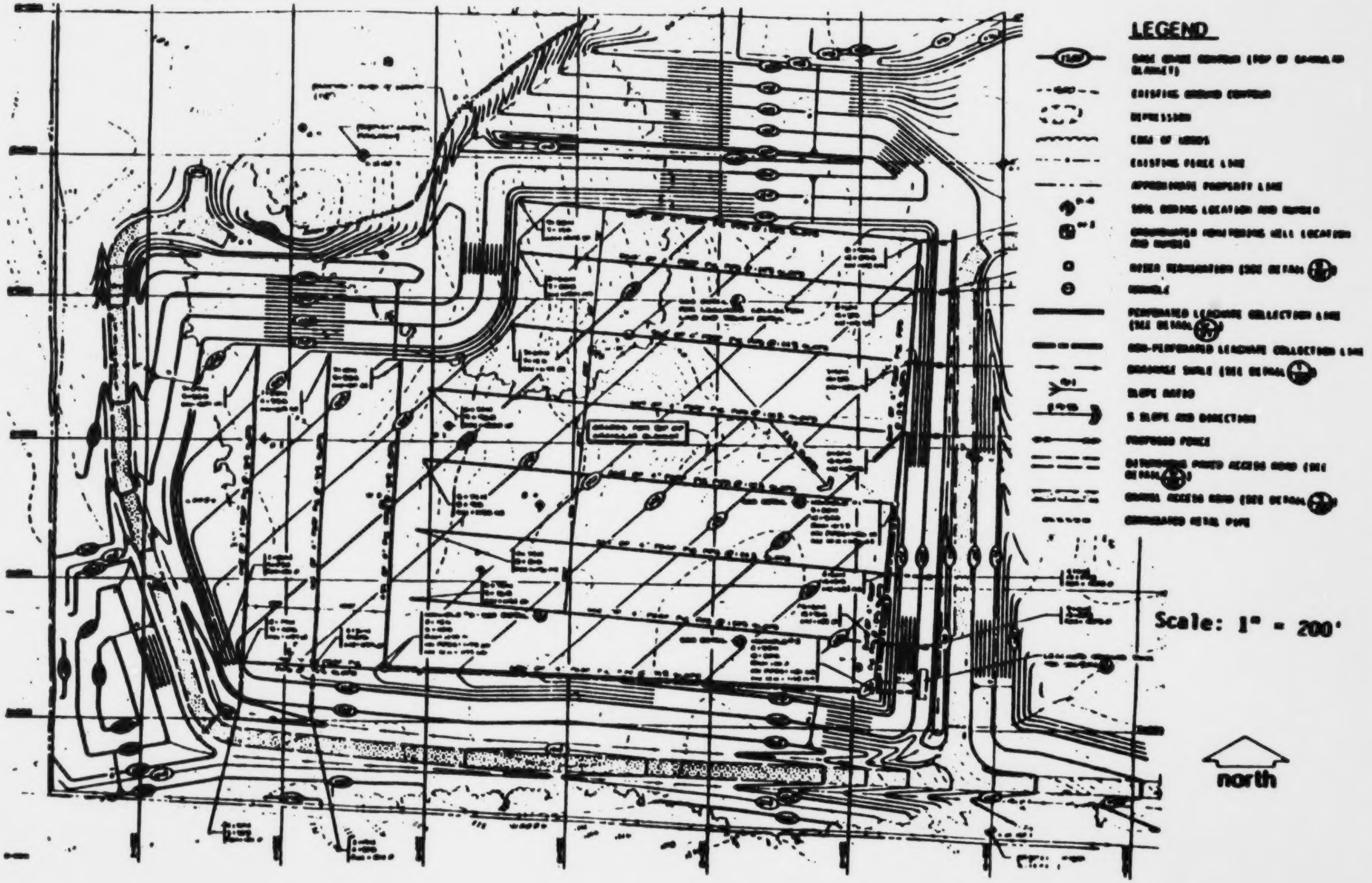

LEGEND
BASE GRADE CONTOUR (TOP OF GRANULAR BLANKET)
EXISTING GROUND CONTOUR
DEPRESSION
EDGE OF WOODS
EXISTING FENCE LINE
APPROXIMATE PROPERTY LINE
SOIL BORING LOCATION AND NUMBER
GROUNDWATER MONITORING WELL LOCATION AND NUMBER
RISER TERMINATION (SEE DETAIL)
MANHOLE
PERFORATED LEACHATE COLLECTION LINE (SEE DETAIL)
NON-PERFORATED LEACHATE COLLECTION LINE
DRAINAGE SWALE (SEE DETAIL)
SLOPE RATIO
% SLOPE AND DIRECTION
PROPOSED FENCE
BITUMINOUS PAVED ACCESS ROAD (SEE DETAIL)
GRAVEL ACCESS ROAD (SEE DETAIL)
CORRUGATED METAL PIPE
Scale: 1" = 200'
north

Figure 3. Layout of Leachate Collection System.

150 feet. Construction of the leachate collection system is to occur in phases corresponding to the operation of the landfill. Collected leachate is hauled to the Sewage Treatment Plant for treatment and disposal.

Runon and runoff at the site are controlled by a perimeter drainage flume which discharges to infiltration basins. Rainfall which falls in the active area of the site is captured by the leachate collection system.

The feasibility study report for the site describes the installation of a passive gas venting system. This system is to be installed in gravel trenches which will be constructed in the upper reaches of the landfill prior to closure. No details of the gas venting system were available.

The site design also includes the construction of a collection lysimeter beneath the Phase I liner. The lysimeter consists of a perforated PVC pipe installed in a trench lined with a synthetic membrane. The collection pipe drains to a manhole where leachate is collected. The purpose of the collection lysimeter is to measure the volume of leachate which passes through the clay liner.

2.4 OPERATION AND MANAGEMENT PRACTICES

The number of employees at the site and the equipment used at the site were not specified in the facility file. The facility will be developed in 4 phases using the area fill method of disposal. The layout of the phases is shown in Figure 4. Phases I through III will have refuse capacities of 282,506; 370500; and 291,862 yd^3, respectively. These phases will have an average fill thickness of approximately 34 feet and a maximum thickness of approximately 60 feet. The base of the fill will range from approximately 30 feet below existing grade to approximately 30 feet above existing grade, depending on topography. Phase IV will cover the entire site area and will be emplaced above the first three phases. Phase IV will have a refuse capacity of 287,546 yd^3 and an average thickness of approximately 10 feet.

Refuse will be compacted daily and covered with 6 inches of daily cover. Because of the phased operation, Phase I through III will be covered with an intermediate cover consisting of 2 feet of compacted clay and 6 inches of topsoil. This intermediate cover will then be removed progressively as Phase IV is constructed. Phase IV will be

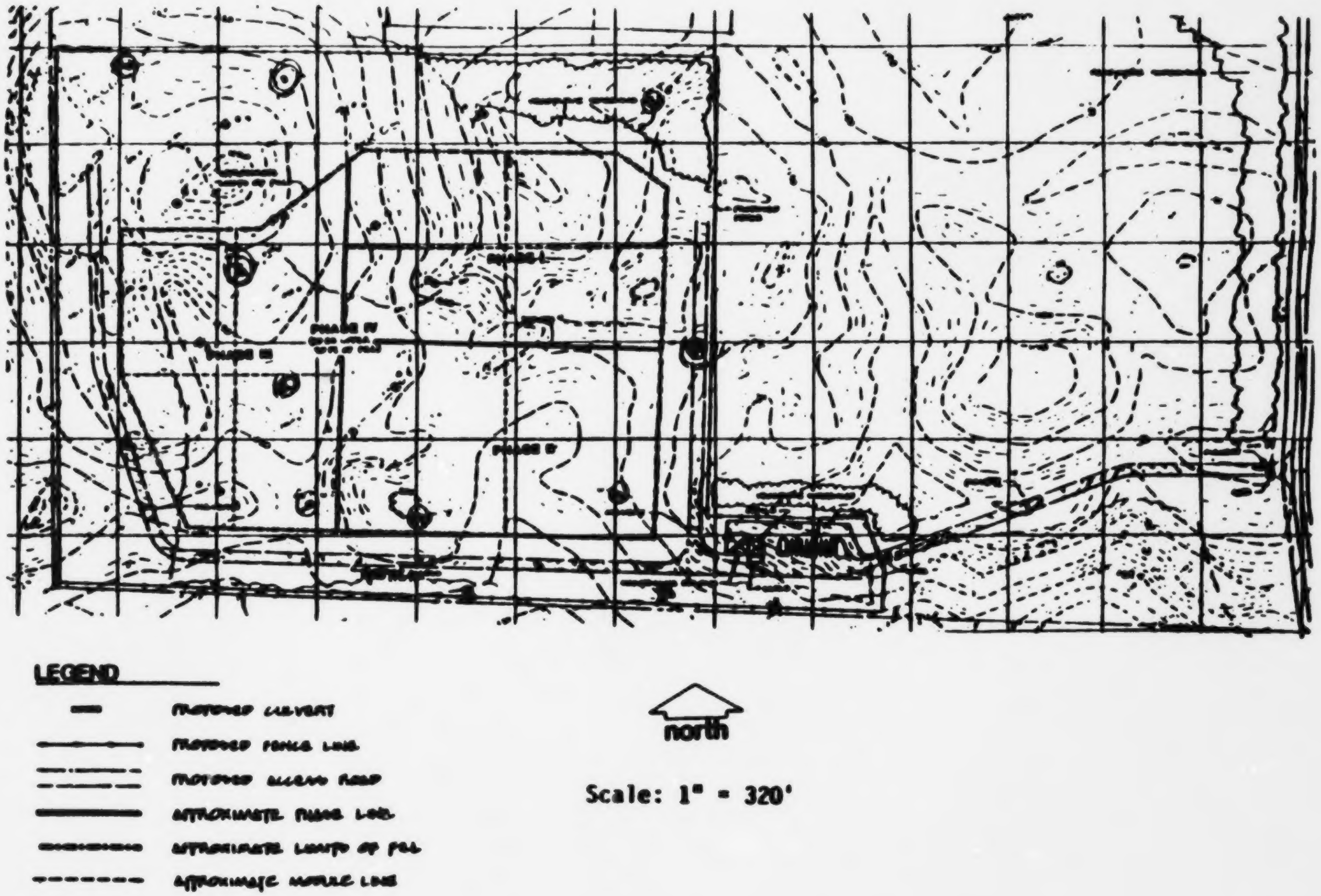

LEGEND
PROPOSED CULVERT
PROPOSED FENCE LINE
PROPOSED ACCESS ROAD
APPROXIMATE PHASE LINE
APPROXIMATE LIMITS OF FILL
APPROXIMATE [illegible] LINE
north
Scale: 1" = 320'

Figure 4. Phased Development of the PC Sanitary Landfill.

covered with a final cover consisting of 2 feet of compacted clay soil and 6 inches of topsoil. The final site grade is shown in Figure 5.

3.0 ENVIRONMENTAL IMPACT

3.1 MONITORING

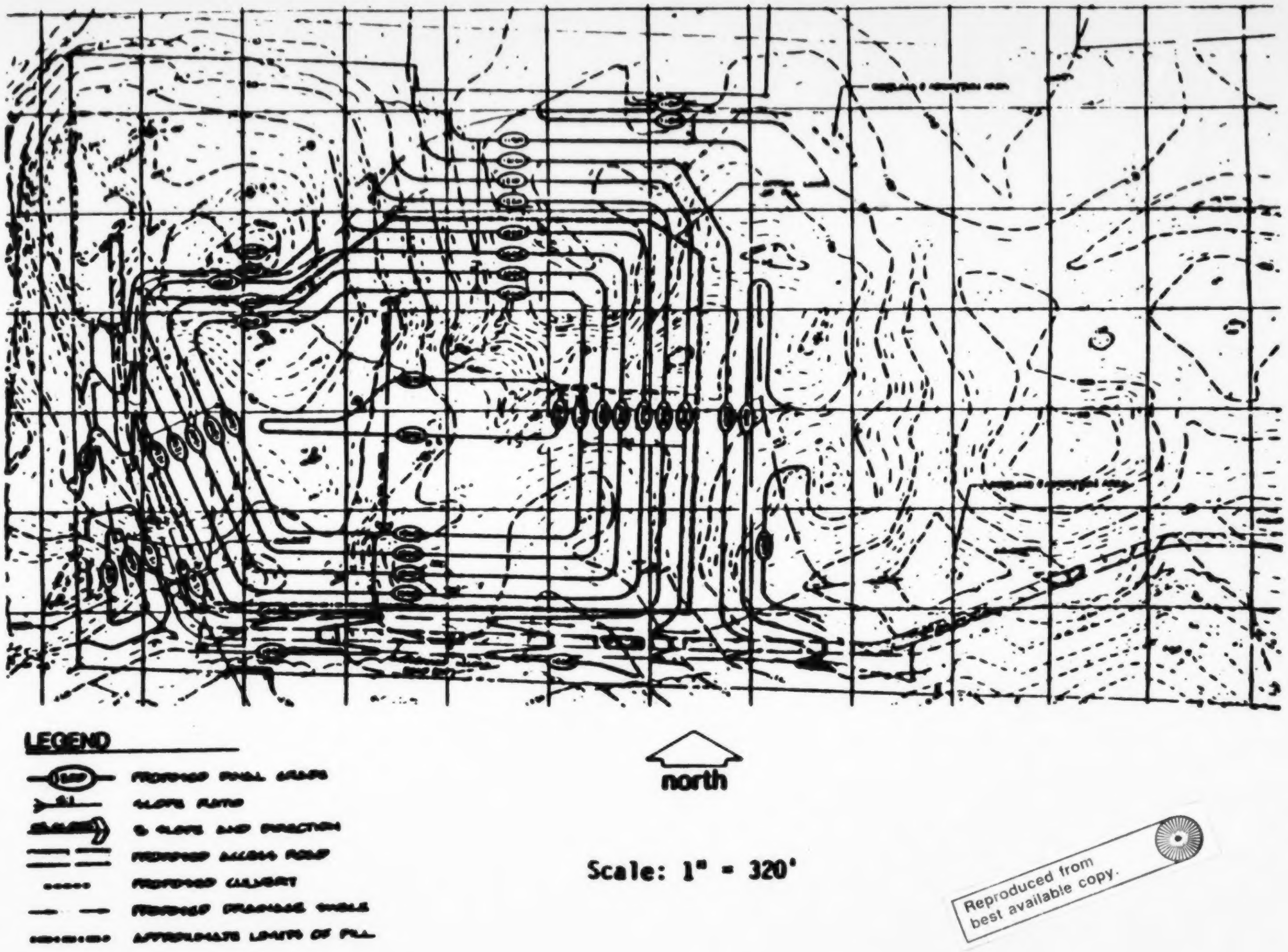
The facility permit operating conditions require groundwater monitoring during the active life of the site and for 20 years after closure. These conditions specify monitoring of 19 wells during Phase I, 23 wells during Phase II, and 25 wells during Phase III and Phase IV. Available well locations and the local groundwater flow direction are shown in Figure 6. Typical well construction details are shown in Figure 7.

3.2 DAMAGE ASSESSMENT

No environmental damage at the site has been documented. The results in Table 1 are not indicative of leachate contamination of groundwater.

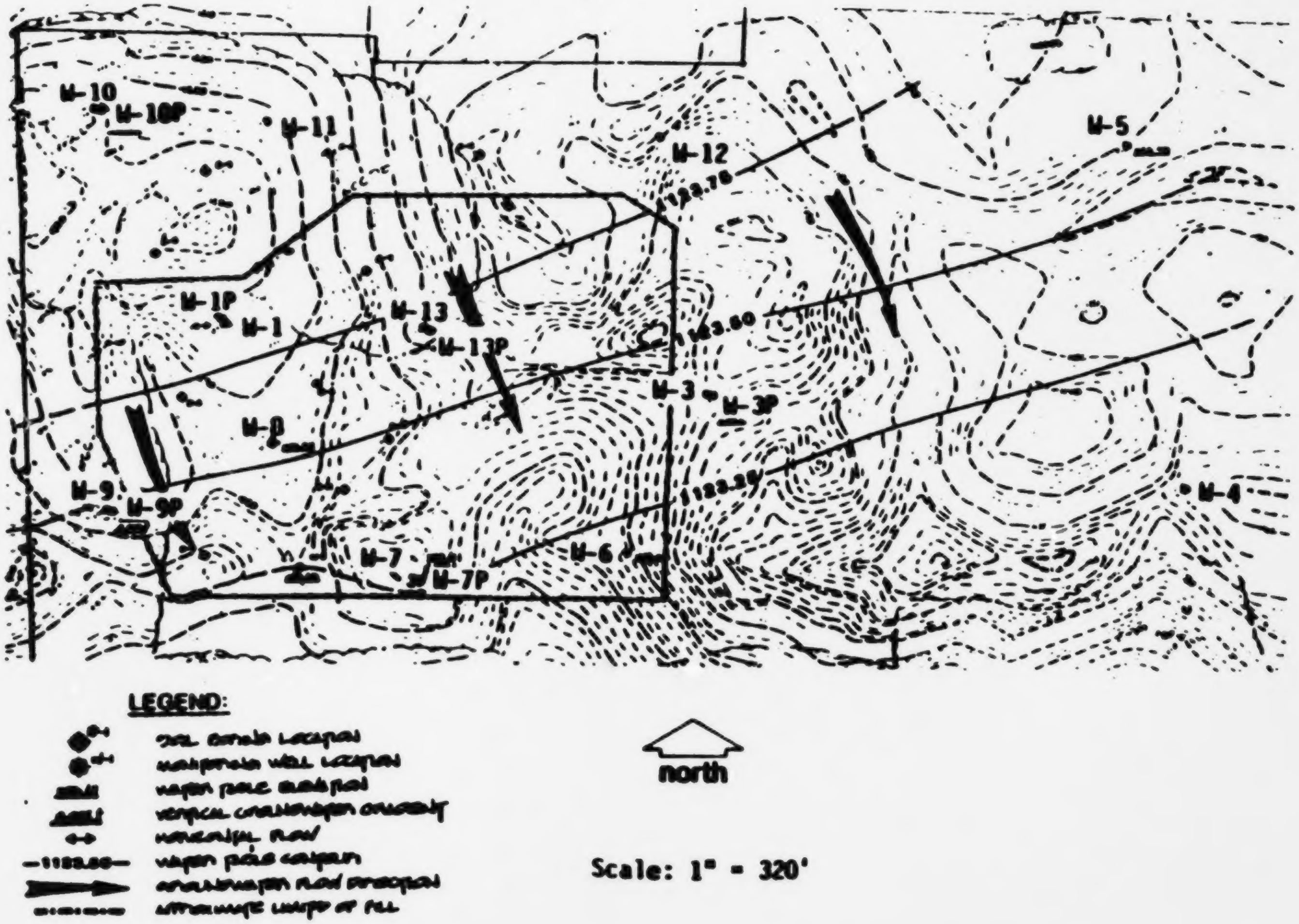
3.3 CORRECTIVE ACTIONS

No corrective actions have been required or taken at the site.


LEGEND
PROPOSED FINAL GRADE
SLOPE RATIO
% SLOPE AND DIRECTION
PROPOSED ACCESS ROAD
PROPOSED CULVERT
PROPOSED DRAINAGE SWALE
APPROXIMATE LIMITS OF FILL
north
Scale: 1" = 320'

Reproduced from best available copy.

Figure 5 Final Grades at the PC Sanitary Landfill.



W-10
W-10P
W-11
W-12
W-5
W-1P
W-1
W-13
W-13P
W-3
W-3P
W-8
W-9
W-9P
W-7
W-7P
W-6
W-4
1123.78
1123.80
1123.29
LEGEND:
SOIL BORING LOCATION
MONITORING WELL LOCATION
WATER TABLE ELEVATION
VERTICAL GROUNDWATER GRADIENT
HORIZONTAL FLOW
WATER TABLE CONTOUR
GROUNDWATER FLOW DIRECTION
APPROXIMATE LIMITS OF FILL
north
Scale: 1" = 320'

ater Flow Direction at

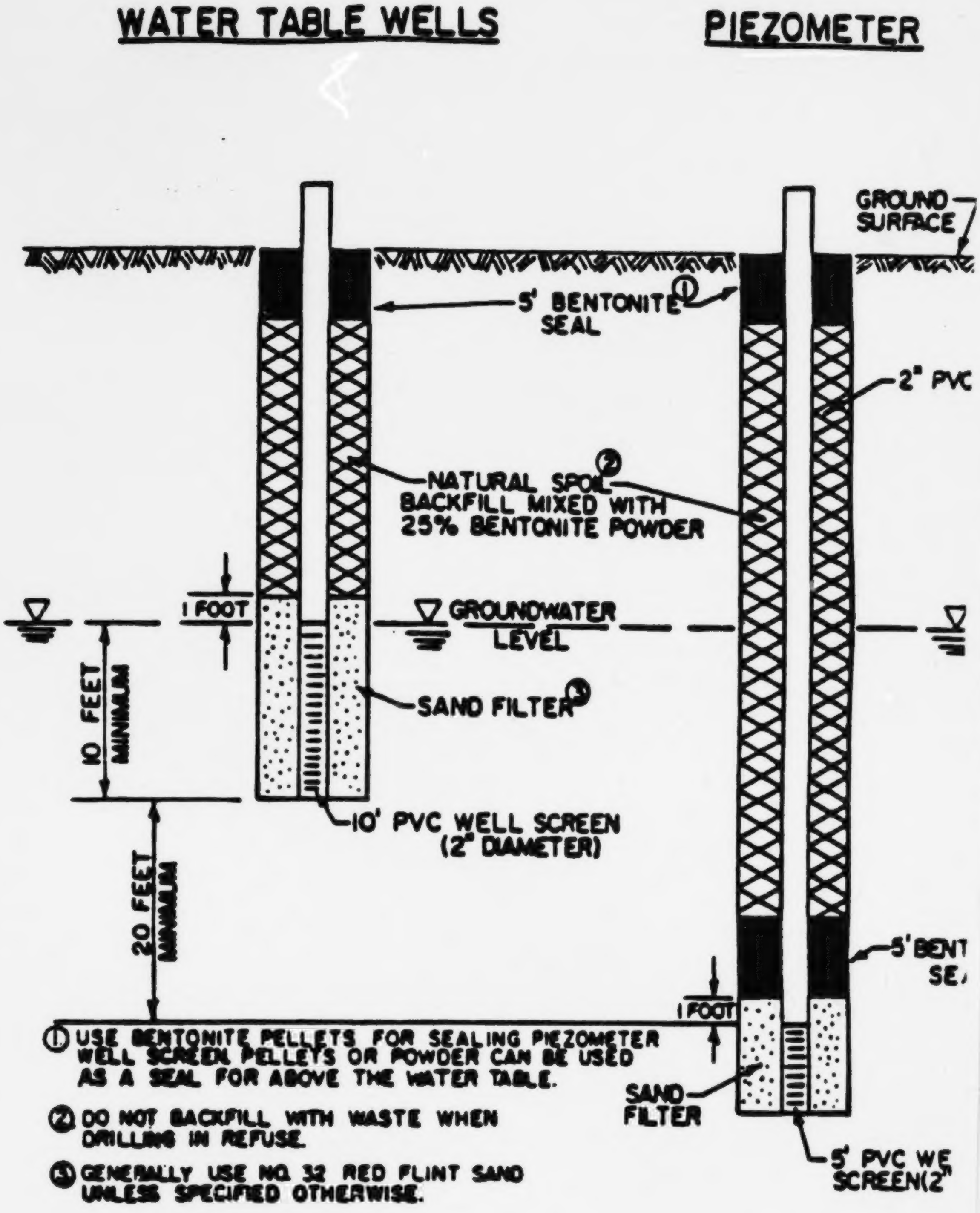

WATER TABLE WELLS
PIEZOMETER
GROUND SURFACE
5' BENTONITE SEAL ①
2" PVC
NATURAL SPOIL ② BACKFILL MIXED WITH 25% BENTONITE POWDER
1 FOOT
GROUNDWATER LEVEL
10 FEET MINIMUM
SAND FILTER ③
10' PVC WELL SCREEN (2" DIAMETER)
20 FEET MINIMUM
5' BENT SE
1 FOOT
SAND FILTER
5' PVC WE SCREEN(2"
① USE BENTONITE PELLETS FOR SEALING PIEZOMETER WELL SCREEN. PELLETS OR POWDER CAN BE USED AS A SEAL FOR ABOVE THE WATER TABLE.
② DO NOT BACKFILL WITH WASTE WHEN DRILLING IN REFUSE.
③ GENERALLY USE NO. 32 RED FLINT SAND UNLESS SPECIFIED OTHERWISE.

Figure 70. Typical Monitoring Well Construction Details.

Table 1. Groundwater Monitoring Data for PC Sanitary Landfill, September, 1985

Well	Cl^-	COD	pH	Alk.	Cond.	Hard.	Fe
W-1	4	4.1	7.25	220	495	246	<.02
W-1P	1	4.8	7.48	182	400	189	.10
W-2		BAILER STUCK IN WELL					
W-3	1	8.2	7.25	136	295	137	<.02
W-3P	<1	1.4	7.40	236	460	242	<.02
W-7	<1	1.4	7.49	168	342	170	<.02
W-7P	1	2.0	7.45	210	440	229	<.02
W-9	3	3.4	7.40	323	465	239	<.02
W-9P	4	6.8	7.38	224	475	239	<.02
W-10	8	5.4	7.22	220	500	246	<.02
W-10P		BAILER STUCK IN WELL					
W-11	4	11.6	7.28	242	498	248	.25
W-12	6	5.4	7.50	184	390	191	<.02
W-17	2	2.7	7.45	214	420	216	<.02
W-18	1	2.0	7.88	146	300	152	<.02
W-20	<1	4.8	7.62	166	348	166	<.02
W-20P	2	5.4	7.50	202	432	210	<.02
W-21	<1	4.1	7.52	178	360	187	<.02
W-21P	<1	1.4	7.50	204	435	212	<.02
W-22	<1	2.7	7.72	172	342	176	<.02
W-22P	<1	2.3	7.70	176	360	181	<.02
W-23	1	2.0	7.45	290	550	286	<.02
W-23P	<1	1.4	7.78	162	335	168	.04
L-1	0.29	12.9	7.30	256	699	326	<.02
Leachate Tank	359	9,333	6.93	2,000	5,810	2,260	53.5
Infiltration Basin No. 1	2	98.6	7.19	18	48	24	.24
Infiltration Basin No. 2	5	35.8	7.66	26	93	36	.02
Infiltration Basin No. 3	16	33.3	7.70	102	252	102	.04

Note: All results in mg/l except pH (standard units) and conductivity (umho/cm).

4.0 COST DATA

The facility file contains a detailed cost estimate prepared as part of the feasibility study study report. Major cost elements are reported below on a present worth bases (1981 dollars).

Pre-development Costs	$ 252,500
Site Preparation Costs	1,041,715
Site Operation and Maintenance Costs	4,847,200
Site Abandonment Costs	107,720
Long-Term Maintenance Costs	475,310
Total Costs	$6,724,445

This total cost amounts to $10.91 per ton of waste based on an estiamted site capacity of 616,200 tons.

APPENDIX C

NUS TRIP REPORT

RCRA WORK ASSIGNMENT NO. 4
FEBRUARY 2 THROUGH 6, 1987
PROJECT NO. Y950

TO:	HAIA ROFFMAN
FROM:	DENICE TAYLOR
APPROVAL:	M.S. ULINTZ
COPIES:	TERRY ROJAHN ROB MARKWELL GREG ZIMMERMAN

Introduction

During the week of February 1, 1987, NUS personnel conducted field sampling of six municipal waste landfills to provide baseline data for Phase I of RCRA Work Assignment 4. The objective of the project is to evaluate potential health and environmental effects of leachates generated by municipal landfills.

Scope of Work

The scope of work for Phase I involved collecting three leachate samples at six municipal landfills, and incinerator ash samples from two sites where such ash is co-disposed with solid waste. Site selection was based on the existence of a leachate collection system, the accessibility and location of the site, and the presence of a working incinerator for the ash sites. A brief description of each site, containing information gathered through telephone conversations and field observations and sample location maps is included as Attachment A. A photograph index documenting field operations and site conditions is included as Attachment B.

Two duplicate samples and one field blank were collected as QA/QC measures. The duplicates were collected at the same time and handled in the same manner as other leachate samples; the field blank consisted of HPLC grade water which was preserved and analyzed as a leachate sample.

Changes in the Scope of Work

Prior to beginning field work the following changes were made in the scope of work:

1. The leachate samples collected from each site would be replicates. If distinct leachates were generated at a given site, they were composited in proportion to the volumes generated.

2. If it was raining or had rained prior to sample collection, a sample would be taken of the rainwater from a clean puddle or depression and analyzed to determine the characteristics of water infiltrating the waste.

3. Traditional water chemistry parameters were added to the analyses. Because of the difficulty involved in shipping preservatives, the aliquots marked for water chemistry were preserved by the NUS lab. See Attachment C for a complete list of analytical requirements and laboratory information.

4. In addition to pH, specific conductivity and temperature, redox potential was included as a field measurement.

Field Operations

Sample data including times, dates, locations, and field measurements are listed in Attachment D. The following is a summary of field operations during the week of February 1, 1987.

Team 1 (Denice Taylor, Terry Rojahn)

February 2, 1987: Collected, preserved, packaged, and shipped samples PC-LE-001, PC-LE-002, PC-LE-003, and PC-LE-003A.

February 3, 1987: Collected, preserved and packaged samples SM-LE-001, SM-LE-002, SM-LE-003, and SM-LE-004.

February 4, 1987: Shipped SM facility samples.

February 5, 1987: Collected, preserved, packaged, and shipped samples VD-LE-001, VD-LE-002, VD-LE-003, and VD-LE-000.

DST:lld

Attachments

TEAM 2 (ROB MARKWELL, GREG ZIMMERMAN)

February 2, 1987

The sampling team arrived at the NY Landfill at 11:20 and met the Landfill Supervisor. The Resource Recovery facility supervisor also arrived to discuss the sampling plan and to answer any questions.

The ash sample was collected from a fresh pile, prior to it being disposed in a cell. The sampling team was informed as they sampled the ash that it was probably from a startup burn and the material had not been exposed to the actual operating temperatures of between 1600°F and 2100°F.

All 3 leachate samples were collected from the leachate flow as it entered a collection sump. The samples were collected using an amber glass bottle taped to a pole. The leachate was gray with some turbidity associated with it. The samples took approximately 45 minutes to collect. Once the samples were collected, field measurements of the samples were made and the samples were then preserved, labelled, and packaged for shipment according to the procedures outlined in the scope of work.

February 4, 1987

The sampling team arrived at the FL Landfill at 08:15 and spoke with the Facility Supervisor.

The sampling team collected all 3 leachate samples from the lone collection sump. The leachate is normally pumped from this sump into a tank truck and hauled to the local Wastewater Treatment Plant. Samples were collected by lowering a stainless steel beaker on a polypropylene rope into the leachate that had collected in the collection sump. The leachate was gray with some turbidity associated with it.

Again, the samples took approximately 45 minutes to collect. Once the samples were collected, field measurements of the samples were made and the samples were then preserved, labelled, and packaged for shipment according to the procedures outlined in the scope of work.

February 6, 1987

The sampling team arrived at the NC Landfill at 09:00 after meeting with the Facility Supervisor at his office.

The leachate samples were collected from 2 collection sumps in a 10-acre closed cell and from 1 collection sump for the 2 and 1/2 acre active area. The samples were collected by lowering a stainless steel bailer on a polypropylene rope into the leachate that had collected at the bottom of each sump. All four samples (includes a duplicate) were composited 1/3, 1/3, and 1/3 from each sump. The leachate from the closed area was light gray and almost free of turbidity, while the leachate from the active area ranged from light gray and slightly turbid to black and very turbid.

ATTACHMENT A

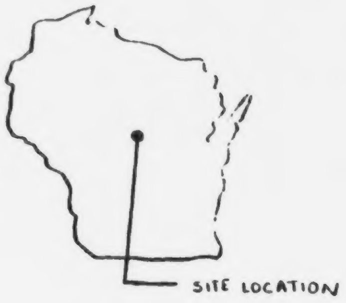
SITE SUMMARIES AND
SAMPLE LOCATION MAPS

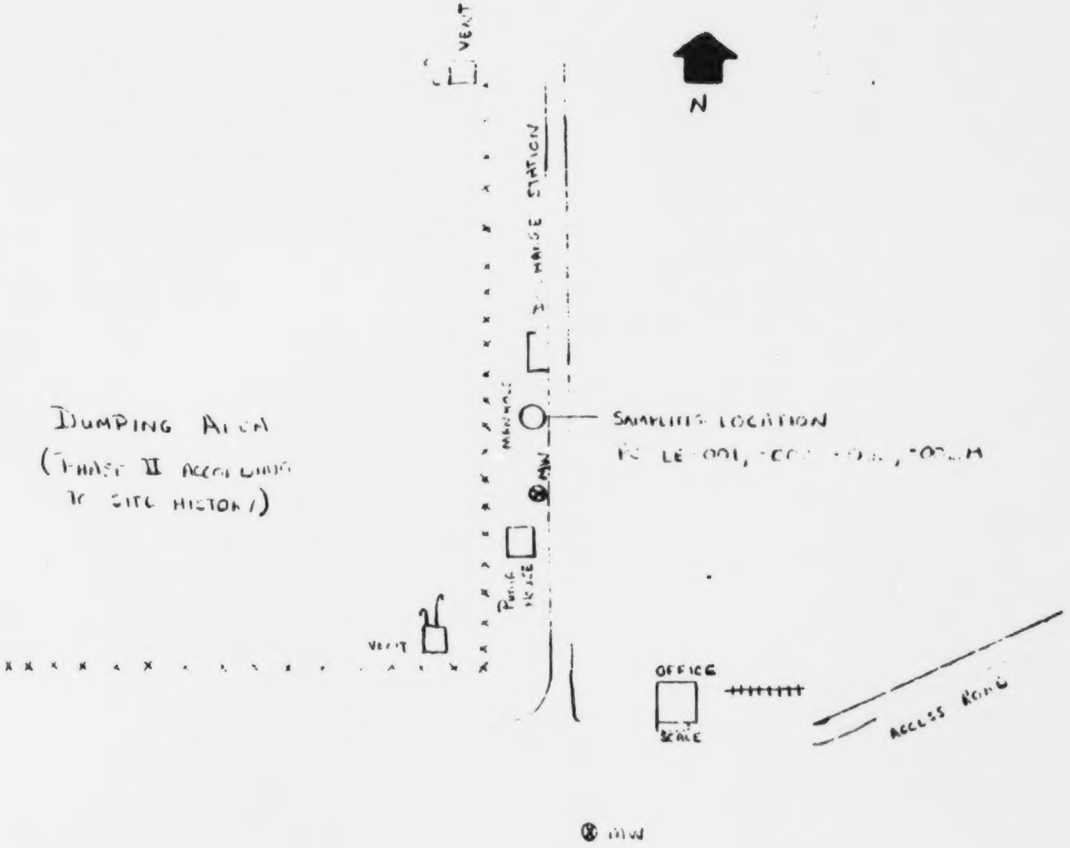
The PC Landfill

All leachate is collected in a 20,000 gallon holding sump accessible via a manhole. (Figure 1 shows sample locations and site details). When the sump is full, the leachate is pumped to a tanker truck and taken to the City Sewage Treatment Plant. The schedule for disposal depends on the amount of rainfall and may range from everyday during wet months to every week and a half during dry months. The sump was being emptied February 2, 1987, the day of sampling; it had last been emptied a week and a half before. It is not possible to enter the sump without wearing a breathing apparatus. Samples were collected by lowering a bailer into the tank.

It appears from site plans that the facility has entered Phase II of development. Presently, there are 24 monitoring wells on site which are being sampled quarterly for conventional parameters. In addition, leachate samples are collected and analyzed once a year.

A detailed case study of the site, dated July 1986, has been prepared and is on file with EPA.


SITE LOCATION


N
VENT
PUMP HOUSE STATION
MANHOLE
SAMPLING LOCATION
LE-001,
MW
PUMP HOUSE
VENT
DUMPING AREA
(PHASE II ACCORDING TO SITE HISTORY)
OFFICE
SCALE
ACCESS ROAD
MW

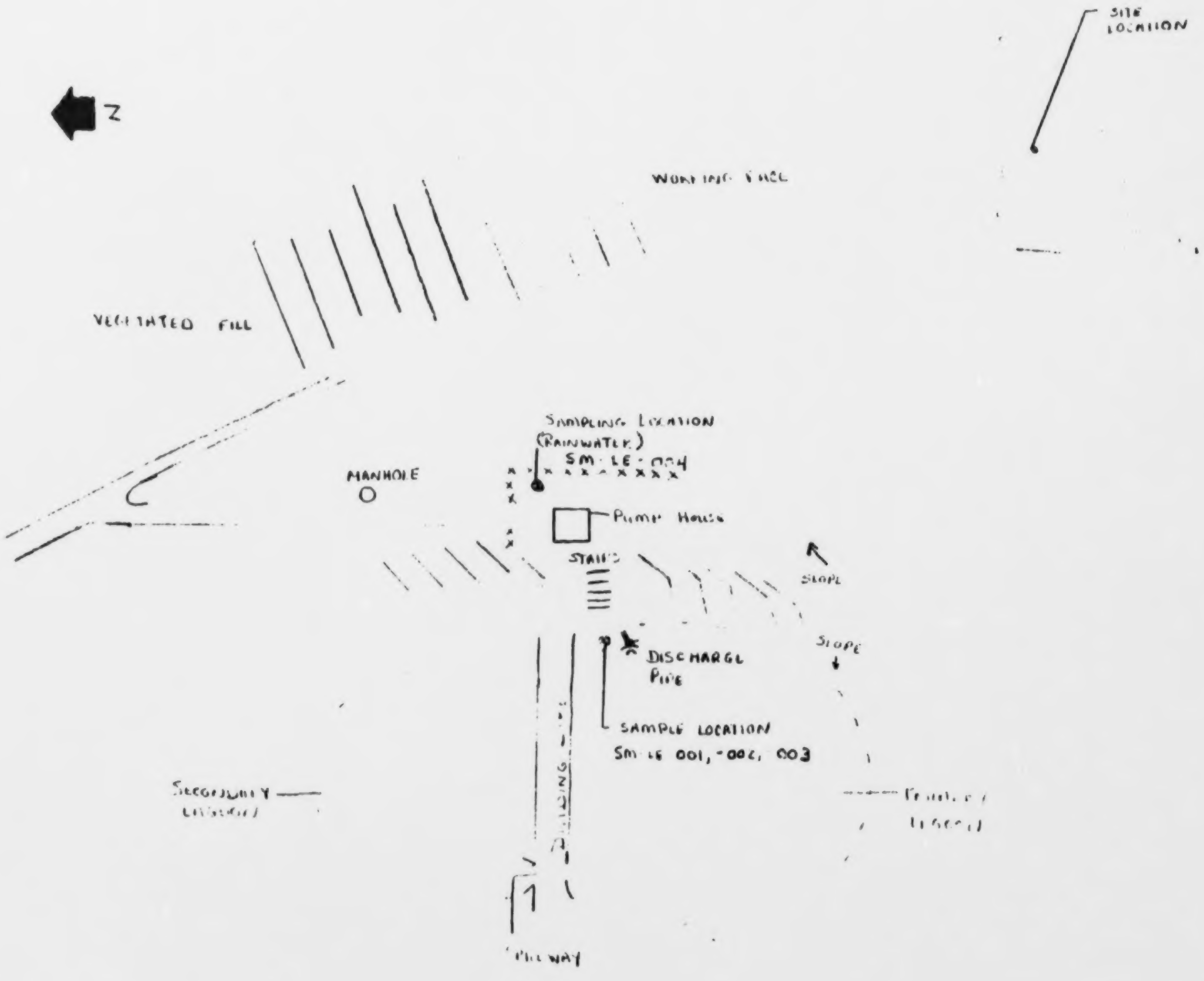
The SM Landfill

All leachate generated from the facility, as well as surface water diverted from the fill area, is collected in one sump prior to discharge to a two stage lagoon. (Figure 2 shows sample locations and site details). An automatic pump empties the sump on average of once an hour during the wetest months and once or twice a day during drier times. (During sampling the sump was emptied twice). In the summer, leachate from the secondary lagoon is sprayed over the vegetated area of the fill.

About two years ago, a tanker permitted to dispose of glue sludge from the plywood industry emptied thick black oil into a manhole draining to the collection sump. The responsible party was required to remove as much oil as possible at the time, and periodically they are called to remove any additional accumulation. At the time of sample collection, there was at least a one foot layer of oil in the sump. In order to collect a more representative sample, the samples were collected from the primary lagoon at the discharge point. There was an irredescent film on the water's surface near the pipe. The site contact also mentioned that there are plans for expanding the capacity of the lagoons.

Six monitoring wells on site are sampled biannually for conventional parameters. Surface water and leachate samples are collected at the same time and are analyzed for the same parameters.

A detailed case study, dated August 1986 has been prepared and is on file with EPA.

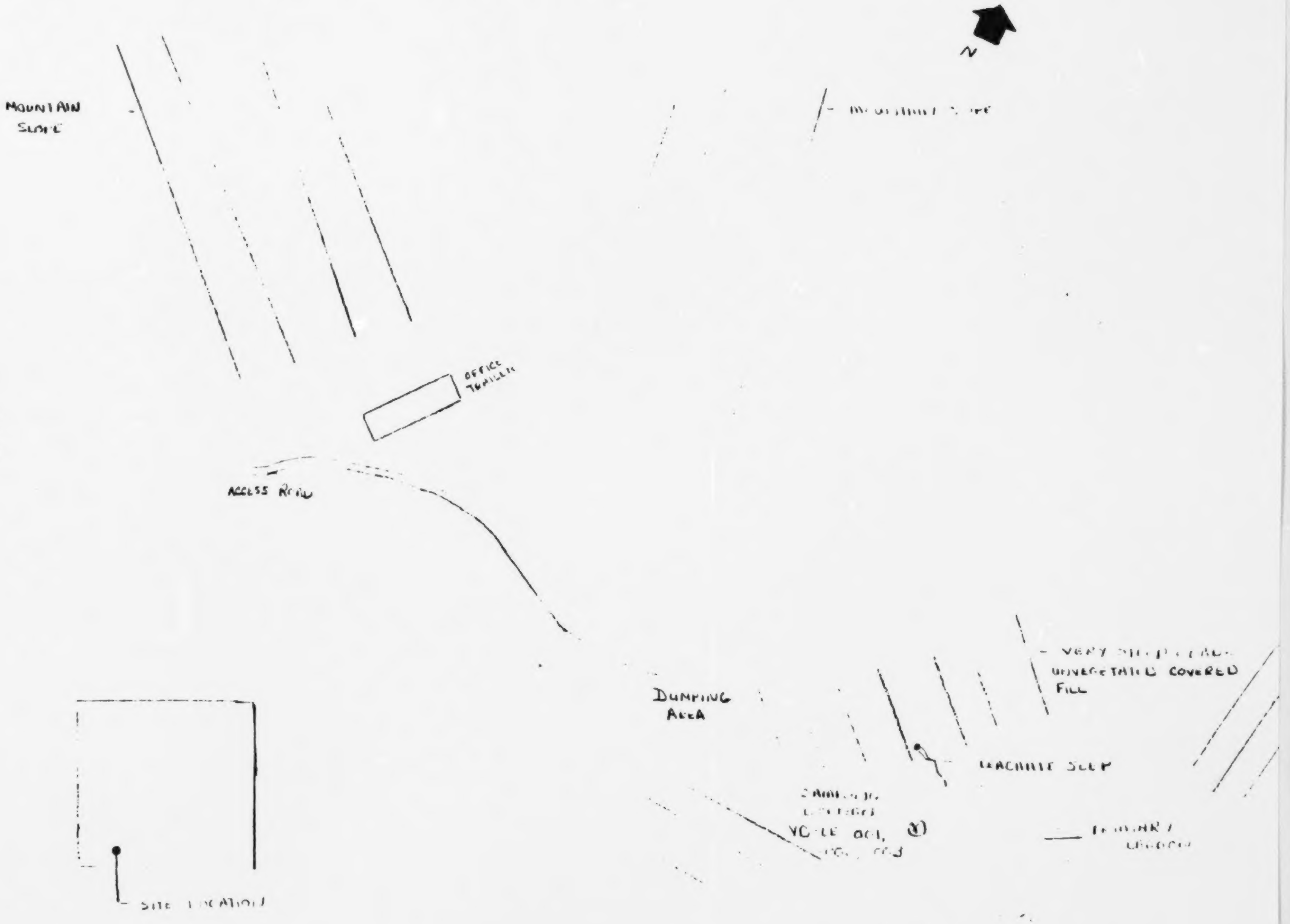

SITE LOCATION
N
WORKING FACE
VEGETATED FILL
SAMPLING LOCATION (RAINWATER) SM-LE-004
MANHOLE
PUMP HOUSE
STAIRS
SLOPE
SLOPE
DISCHARGE PIPE
SAMPLE LOCATION SM-LE 001, -002, 003
SECONDARY LAGOON
PRIMARY LAGOON
SPILLWAY

The VD Landfill

Leachate generated from the fill is collected in a two or three stage lagoon system. It is unclear if there are two separate secondary lagoons. Surface water is diverted around the fill to other drainage ways. When the lagoons reach capacity, leachate from the primary lagoon is pumped and sprayed over the fill. Leachate from the lower lagoon is then pumped to the primary lagoon. A greenish seep was observed flowing from approximately half way downslope to the primary lagoon. The Facility Supervisor later said that the seep formed after an intermittent spring was covered with fill and that it flows only during wet periods. (Figure 3 shows sample location and site details).

There are no monitoring wells at this site.

A detailed case study, dated June 1986, has been prepared and is on file with EPA.


N
MOUNTAIN SLOPE
MOUNTAIN SLOPE
OFFICE TRAILER
ACCESS ROAD
DUMPING AREA
UNVEGETATED COVERED FILL
LEACHATE SEEP
SITE LOCATION

The NY Landfill

The landfill accepts ash from the Resource Recovery facility, Wastewater Treatment Plant sludge, and municipal solid waste in excess of the incinerator's capacity.

The landfill began operation in April of 1985. The Deputy Commissioner of Energy Recovery Facility, provided the following numbers in regards to the types of waste disposed in the landfill in 1986:

- 28206 tons of ash
- 6886 tons of bypass refuse (materials in excess of incinerator's capacity)
- 1119 tons of hardfill (metal scrap, building materials, mattresses, etc. sorted out before incineration)
- 3000 yards of sewage sludge ash (density unknown)
- 5000 yards of sewage sludge (density unknown)
- 80 yards of humane society wastes

He did not have numbers available for 1985, but did indicate that the facility did not receive the sewage or animal wastes prior to 1986.

The landfill has 2 clay liners with a leachate collection system above the first liner. A leak detection system is located between the 2 liners with no leaks being reported as of yet. The landfill has no groundwater monitoring system because it is located next to a hazardous waste site. The hazardous waste site has its own groundwater monitoring system.

The leachate collection system drains into a collection sump, the leachate is pumped from there to a holding tank, and flows from the holding tank into the main sewage line. The leachate mixes with the domestic sewage before it enter the City Wastewater Treatment Plant (9MGD).

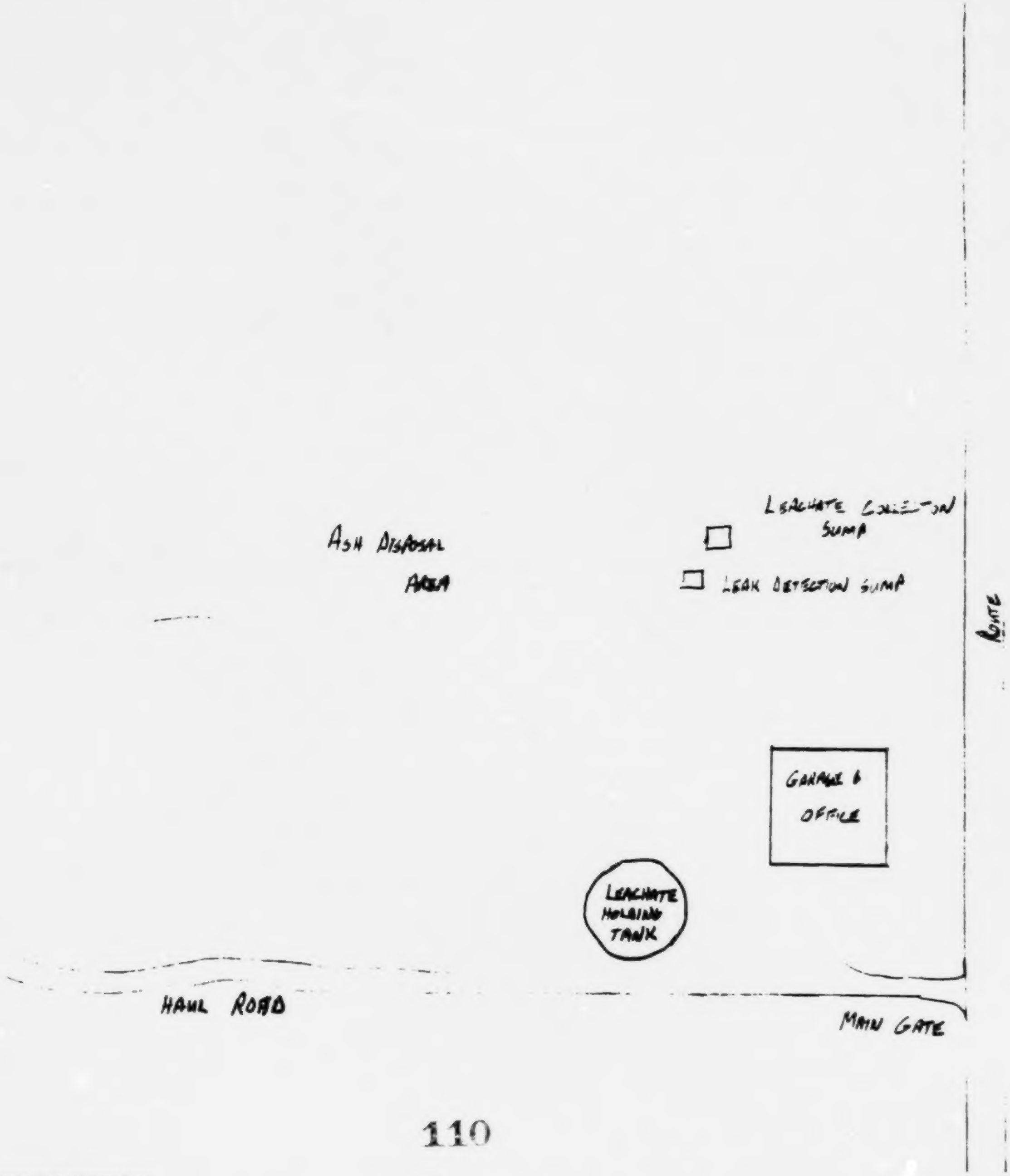

LEACHATE COLLECTION SUMP
ASH DISPOSAL AREA
LEAK DETECTION SUMP
ROUTE
GARAGE & OFFICE
LEACHATE HOLDING TANK
HAUL ROAD
MAIN GATE

FIGURE 1

The FL Landfill

Details on the construction and operation of the FL Landfill are available in a case study on file with EPA.

The NC Landfill

The landfill accepts ash from the Resource Recovery facility, calcium nitrite from a local fertilizer manufacturer, and municipal solid waste in excess of the incinerator's capacity. The County Environmental Specialist, estimates the ratio of ash to solid wastes to be 1 to 3. The ash is used as a daily cover.

The landfill consists of numerous cells. One ten acre cell has been closed and the construction of a clay cap for it has been started. The wastes are currently being placed in a two acre cell. Each cell is lined with 3 feet of sand, a high density liner, another 2 feet of sand, and a 20-mil PVC liner. A leachate collection system is placed above the first liner of each cell and a leak detection system has been placed between the liners. A groundwater monitoring system is also in place. The leachate, once it has been collected, is pumped to a lined lagoon, and then to the treatment system. From the treatment system, the leachate flows to a NPDES permitted surface stream discharge.

A detailed file on the leachate characteristics from the landfill is available at the facility.

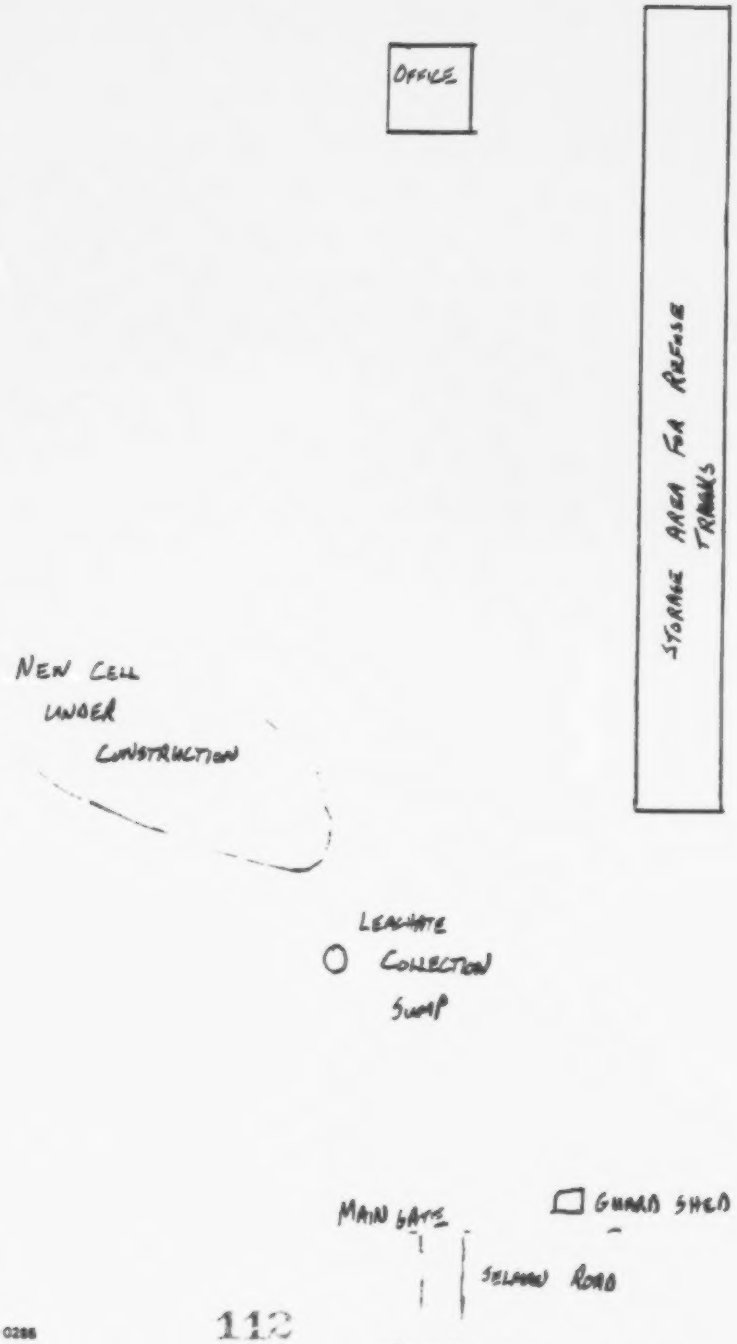
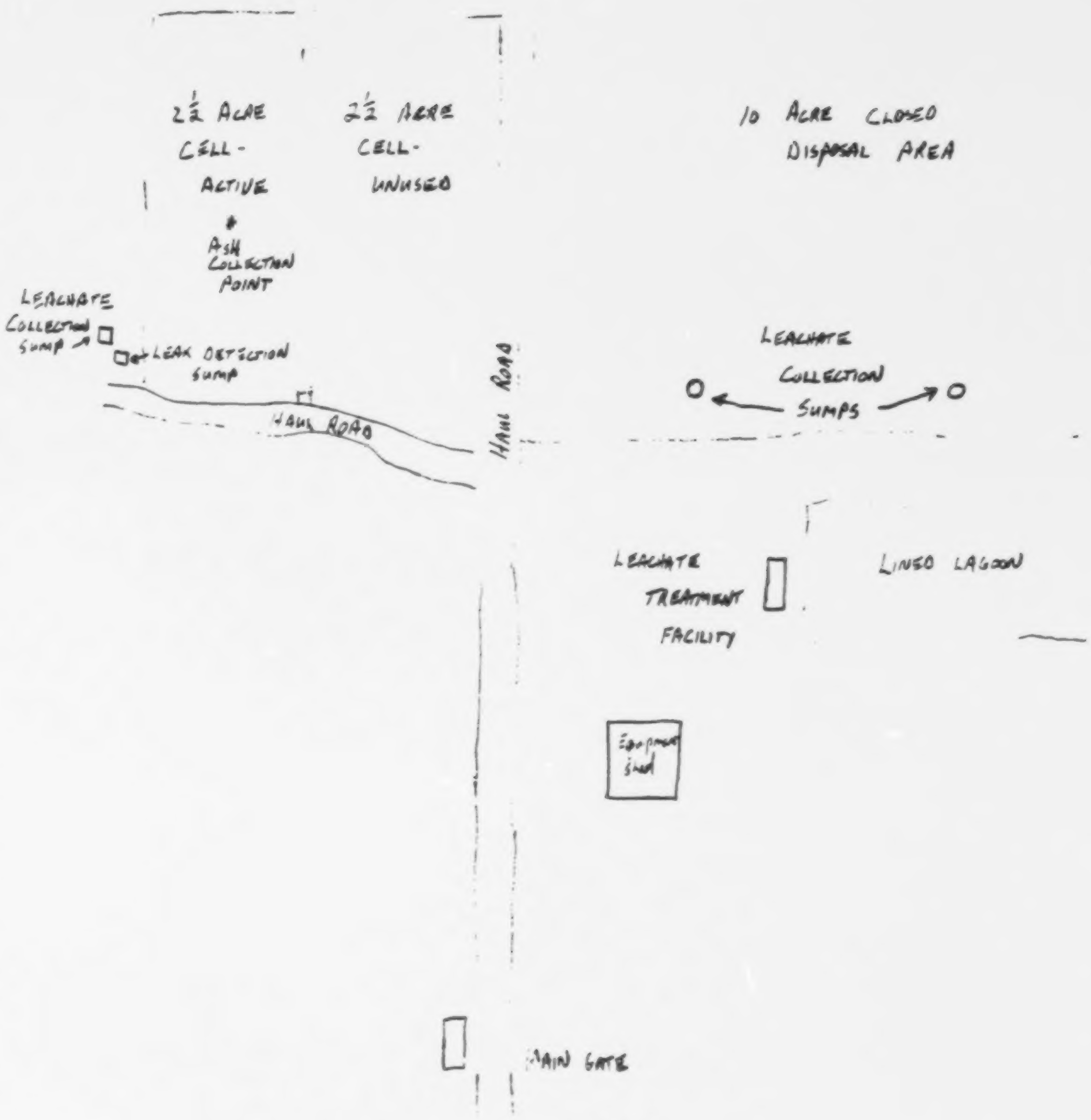

OFFICE
STORAGE AREA FOR REFUSE TRUCKS
NEW CELL UNDER CONSTRUCTION
LEACHATE COLLECTION SUMP
MAIN GATE
GUARD SHED
SELDEN ROAD

FIGURE 2


2½ ACRE CELL- ACTIVE
2½ ACRE CELL- UNUSED
10 ACRE CLOSED DISPOSAL AREA
ASH COLLECTION POINT
LEACHATE COLLECTION SUMP
LEAK DETECTION SUMP
HAUL ROAD
HAUL ROAD
LEACHATE COLLECTION SUMPS
LEACHATE TREATMENT FACILITY
LINED LAGOON
Equipment Shed
MAIN GATE

113

FIGURE 3

ATTACHMENT B

PHOTOGRAPH INDEX

ATTACHMENT B

Photograph Index
PC Landfill
February 2, 1987
Photographer: Terry Rojahn

Photo	Description
R1P1	Photo of leachate being pumped into tanker for shipment to treatment facility.
R1P2	View of manhole access for leachate collection sump, sampling location for PC-LE-001, -002, -003, and -003A. An active dumping area is pictured in the background. Note the monitoring well to the left of the manhole.
R1P3	View of pump house located to the left of the manhole.
R1P4	View of the manhole and discharge station.
R1P5	Photo of the discharge station. One vent is located to the right, inside the dumping area.
R1P6	Additional view of monitoring well, dumping area, and another vent to the left of the manhole.

Photograph Index

SM Landfill
February 3, 1987
Photographer: Terry Rojahn

Photo	Description
S1P2	View of rainwater puddle near pump house, sample location SM-LE-004.
S1P4	Photo of pump house. Inside there is a manhole access to the collection sump. The samples could not be collected from the sump due to the presence of a very thick (>1 foot) oil layer. The steps behind the building lead to the primary lagoon.
S1P5	Photo of leachate discharging into the primary lagoon. Samples SM-LE-001, -002, and -003 were collected at this location before the discharge.
S1P6	An additional view of the discharge.
S1P8	View from the far side of the primary lagoon, looking back at discharge.
S1P11	Photo of the spillway from the primary to the secondary lagoon.
S1P13	View across the secondary lagoon from the far side of the dividing dike. The working face of the landfill can be seen to the right in the background. The white pipe in the left background is part of the aeration treatment system. This view is to the left of the pump house.

Photograph Index

VD Landfill
February 5, 1987
Photographers: Terry Rojahn/Denice Taylor

Photo	Description
R2P1	View of location where leachate seep discharges to the primary lagoon.
R2P2	Photo of sample location near leachate discharge point, samples collected were VD-LE-001, -002, and -003.
R2P3	Photo showing sampling location (lower left), flow from the primary to secondary lagoons, and the pump and pipe for the aeration treatment.
R2P4	Additional view of lagoons, pump and pipe.
R2P6	View of source of leachate seep. The blue green puddle in the left foreground is the leachate.
R2P7	Photo of drainage path from leachate seep to primary lagoon. The distance is approximately 50-60 feet.

Photograph Index
NY Landfill
February 2, 1987
Photographer: Rob Markwell

Photo	Description
01	View of the leachate storage tank.
02	Photo of the Leachate Collection Sump. The leachate enters the sump from the direction of the upper left hand corner.
03	Photo of the pump control box on the Leachate Collection Sump.
04	View of the leachate Leak Detection Sump.
05	View of the leachate Leak Detection Sump with the Leachate Collection Sump and pump control box in the background.

Photograph Index
FL Landfill
February 4, 1987
Photographers: Rob Markwell/Greg Zimmerman

Photo	Description
06	Photo of the Leachate Collection Sump with the pump control box on right side of sump. The black hose is for pumping the leachate into the truck that hauls the leachate to the local wastewater treatment plant.
07	Photo of an apparent landfill cell under construction.

Photograph Index
MC Landfill
February 6, 1987
Photographers: Rob Markwell/Greg Zimmerman

Photo	Description
09	Photo of the Leachate Collection Sump for the active portion of the landfill.
10	Photo of the Leachate Collection Sump (one with the lid open) that serves the active portion of the landfill. The pump control box is in the center of the photo. The Leak Detection Sump is to the left of the pump control box. A storm runoff sump is in the far left side of the photo.
11	Photo of the incinerator ash before it is spread as daily cover.
12	View of the Leachate Treatment Basins. (Filters that are located to left of the basins are not pictured).
13	View of the Leachate Treatment Filters with the Basins in the background.
14	View of the Leachate Collection Lagoon with 1 surface aerator operating. The control building is in the right background portion of the photo.
15	View of the Leachate Collection Lagoon with 1 of the 2 Leachate Collection Sumps in the inactive portion of the landfill in the background.
16	Another view of the Leachate Treatment Basins.
17	View of one of the Leachate Collection Sumps in the inactive portion of the landfill.
18	Another view of one of the Leachate Collection Sumps in the inactive portion of the landfill. Photo was taken from the other sump. Leachate collection lagoon is in the right hand portion of the photo. This photo along with the next two photos (19 and 20) are a panoramic view of the lagoons.
19	Photo of Leachate Collection Lagoon.
20	Photo of the Leachate Collection Lagoon. The Leachate Treatment Basin and Filters are in the right hand portion of the photo.

Photograph Index
MC Landfill
Continued

Photo	Description
21	View across the inactive portion of the landfill of the active portion of the landfill. Access roads and an unused cell are located between the inactive and active areas of the landfill.
22	View of the inactive portion of the landfill showing the partial clay cap.
23	View of a pile of tires with the active portion of the landfill in the background.

ATTACHMENT C

ANALYTICAL REQUIREMENTS AND LABORATORY INFORMATION

Analytical Parameters and Laboratory Information

Source: Leachate

Analysis	Container(s)	Preservative	Lab *
volatile organics	(2) 40 ml vial	none	S^3 **
BNA/ Pest/ Herb/ Dioxin	(2) 50 oz amber glass	none	S^3
metals	(1) 1 l PE	HNO_3, pH < 2	S^3
cyanide	(1) 1 l PE	NaOH, pH > 12	S^3
Sulfide	(1) 1 l PE	2ml 2N zinc acetate, NaOH, pH > 9	S^3
TKN, NO_2, NO_3 Organic N, COD, phosphate, TOC	(1) 1 l PE	preserved by lab, H_2SO_4, pH < 2	NUS
Sulfate, Fluoride, Chloride, TDS, TSS, Total alkalinity, hardness	(1) 1 l PE	none	NUS

Source: Ash

Analysis	Container(s)	Preservative	Lab
EP TOX, TCLP, SW 924	(2) 1 qt. jar	none	Versa
metals	(1) 8 oz jar	none	Versa
PCBs	(1) 8 oz jar	none	Versa
Dioxin	(2) 8 oz jar	none	S^3

* S^3 sent (2) 1 l PE containers from each leachate sample to EPA AERL in Atlanta, Georgia for additional analysis.

** 3398 Carmel Mountain Rd. / San Diego, Ca. 92121 / Attn: Joanne Wilkinson / (619) 453-0060

*** 5350 Campbells Run Rd. / Pittsburgh, Pa. 15205 / Attn: Peg Marple / (412) 788-1080

**** 6850 Versar Center / Springfield, Va. 22151 / Attn: Mark Carkhuff / (703) 642-6760.

ATTACHMENT D

SAMPLE DATA

Site Name:	Portage Co. Landfill Stevens Point, WI	Short Mountain Landfill Eugene, OR	Van-Dal Landfill La Plata County Landfill Durango, CO
Sample Numbers:	PC-LE-001, PC-LE-002, PC-LE-003, PC-LE-003A	SM-LE-001 SM-LE-002 SM-LE-003 / SM-LE-004	VD-LE-001 VD-LE-002 VC-LE-003 / VD-LE-000
Date	Feb. 2, 1987	Feb 3, 1987	Feb 5, 1987
Conditions	cloudy, cold, Temp ~ 32°F, ground is snow covered (7-8")	overcast, raining, temp. ~ 50°F	clear, sunny, temp ~ 40°F ground is snow covered in pl
Time	1040	1430 / 1440	0915 / 1030
Sample Temp (°C)	11.3	18.0 / 18.1	9.6 / 15.0
Specific Conductivity	8800	300 / 270	3900 / 20
pH	7.25	7.8 / 7.05	6.98 / 7.45
Adjusted Eh:	~ -81	-486 / -78	-411 / -146
Sample description:	The samples were collected from the sump near the pumping station. The samples were black and very murky.	The leachate samples were collected from the first leachate lagoon, beside the discharge pipe. The rainwater sample, SM-LE-004, was collected	The leachate samples collected from the first leachate lagoon near the point were the leachate seep entered the lagoon. The blank, VC-LE-000, consisted of
Remarks/Comments (cont'd)	~15-25 ml HNO3 were needed to bring the metals sample to pH < 2; there was a foaming reaction and a color change to reddish brown.	from a depression near the pump house. The leachate samples were blackish green with an oily film. SM-LE-004 was clear	HPLC grade water. The leachate samples were reddish brown with some sediment. The blank was [illegible]

SITE NAME:	Portage County Landfill Stevens Point, WI	Short Mountain Landfill Eugene, OR	Bon-Dal Landfill Durango, CO
Remarks/Comments	When the NaOH was added to the cyanide sample, the color changed to a greenish yellow and a wht precipitate formed Sample PC-LC-003A was sent as the QA duplicate.	In the leachate sample, ~5-7 ml HNO_3 were needed to bring the metals sample to pH <2. The color changed to rusty When NaOH was added to the cyanide sample, the color changed to green and a precipitate formed There were no reactions in the rainwater sample	In the leachate sample ~5-10 ml HNO_3 were needed to bring the metals sample to pH <2 There was no drastic color change. When the NaOH was added to the cyanide sample the sample lightened in color, but; a precipitate form There were no reaction in the blank sample.

NUS CORPORATION AND SUBSIDIARIES STANDARD CALCULATION SHEET

CLIENT:
FILE NO.:
BY:
PAGE OF
SUBJECT:
CHECKED BY:
DATE:

Sample Number	Date	Time	Field Parameters				Remarks	Sample Description
			pH	Temp.	Spec Cond.	EH		
NY-LE-001	2-2-87	1230	7.2	5.0 °C	710,000 umhos/cm	-383 mV	Samples collected from 1 leachate collection sump with a glass bottle.	Samples were gray with some turbidity associated with them.
NY-LE-002	"	1245	"	"	"	"		
NY-LE-003	"	1300	"	"	"	"		
NY-[redacted]-001	2-2-87	1200	—	—	—	—	-	-
FL-LE-001	2-4-87	0900	7.05	25 °C	710,000 umhos/cm	-504 mV	Samples collected from 1 leachate ~~sump~~ using stainless steel bunker	Samples were gray with some turbidity associated with them
FL-LE-002	"	0915	"	"	"	"		
FL-LE-003	"	0930	"	"	"	"		
NC-LE-001	2-6-87	1215	7.30	21.1 °C	8,400 umhos/cm	-541 mV	Samples collected from 3 leachate sumps using stainless steel bailer - composited by Volume. [redacted] Duplicate sample provided to S³ for their QA/QC needs	The leachate from the 2 sumps in the closed area was gray and almost free of turbidity. The leachate from 1 sump in the active area ranged from light gray and slightly turbid to black and very turbid.
NC-LE-002	"	"	"	"	"	"		
NC-LE-003	"	"	"	"	"	"		
NC-LE-001A	"	"	"	"	"	"		
[redacted]	[redacted]	[redacted]	-					
NC-ASH-[illegible]	2-6-87	1245	-	—	—	—	—	—

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APPENDIX D

NUS SAMPLING QA/QC PROGRAM

NUS CORPORATION
A Halliburton Company
Superfund Division

OPERATING
GUIDELINES
MANUAL

Number: 4.29
Page: 1 of 29
Effective Date: Draft 2
Revision: 0
Applicability: All Division Activity
Prepared: REMPO-Pittsburgh
Approved: Paul Goldstein
Zone Project Manager

Subject: SAMPLING

1.0 OBJECTIVE

The objective of these guidelines is to provide general reference information on sampling.

2.0 LIMITATIONS

These guidelines are for information only and are not to take precedence over the requirements of project-specific plans for sampling.

3.0 DEFINITIONS

Sampling. The physical collection of a representative portion of a population, universe, or environment.

Environmental Samples. Usually offsite samples with mid- or low-contaminant concentrations such as ambient air, streams, ground water, leachates, ditches, soil, and sediments collected at a distance from direct sources of contaminants.

Hazardous Samples. Samples of "raw" wastes, up to 100 percent by concentration, such as those taken from drums, tanks, and other containers; from waste piles, spills, or onsite lagoons or ditches; and from contaminated soil in the immediate vicinity of waste storage or spill areas.

Sampling Plan. A detailed plan that covers the sampling objectives and strategy.

4.0 GUIDELINES

These guidelines identify the sampling equipment, the sequence of operations, and the documents involved in physical sampling at or near uncontrolled hazardous-substance sites. Reference is made to other descriptive or instructional documents as appropriate.

4.1 OVERVIEW

These guidelines are applicable to the physical sampling of environmental or hazardous-subetance samples. The guidelines cover samples of air, radioactivity, ground and surface water, soils, sediments, sludges, containerized wastes, and wastes that are not containerized.

Sampling has been called the most important part of site activities before remedial actions are planned. It is axiomatic in sampling and analysis that the only true sample is a 100 percent sample and that the subsequent analysis can be only as good as the sample. Obviously, it is either physically impossible or undesirable to take all of a sample source. Therefore, only a representative portion can be taken. How this sample is taken and handled determines, to a large measure, the quality of the ensuing results and their interpretation. It is imperative that uniform, standardized procedures and equipment be used to collect samples. The provision of quality control measures and documentation is also essential. These are legal as well as technical requirements.

Sampling in the Superfund program is closely guided by many EPA documents that originate in several offices, such as the Contract Laboratory Program/Sample Management Office User's Guide; the National Enforcement Investigations Center (NEIC) Contractor's Manual and Policies and Procedures; the Office of Solid Waste Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods; and Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities. The NUS Superfund Training Manual also provides a considerable amount of detailed information about sampling.

These guidelines assume that sampling teams have received prior instruction or formal training in health and safety, site operations, and sampling.

4.2 SAMPLING RESPONSIBILITIES

Project managers are responsible for ensuring that the project specific sampling procedures are followed, maintaining chain of custody, and determining that all sampling documents have been completed properly and are accounted for. Samplers are responsible for collecting samples, initiating chain-of-custody forms, traffic reports, and the necessary sample documents as required. The sampling and analysis coordinator and/or the EPA's Sample Management Office authorized requester is responsible for arranging for sample bottle deliveries and coordinating the activities of the FIT Office and the Sample Management Office.

4.3 SAMPLING EQUIPMENT

Typical equipment used for air and radioactivity sampling is summarized in Table 4.29-1 and sampling equipment for solid or liquid samples is listed in Table 4.29-2. Table 4.29-3 presents container and preservation requirements for samples.

Safety and personnel protection equipment requirements are specified in the health and safety plan. Additional descriptions and sketches of most safety and sampling equipment are given in the Superfund Training Manual under the modules on health and safety, sample handling, and monitoring instruments.

4.4 SAMPLING METHODS

4.4.1 Environmental Samples

Air

If initial site atmospheric hazard surveys have been conducted and levels of personnel protection have been established, surveys for organic/inorganic vapors, oxygen content, combustible gases, and radioactivity must be repeated to confirm previous findings. These surveys are to be repeated periodically, as specified in the sampling plan.

Surface Water

Collecting a representative sample from surface water is difficult but not impossible. Samples should be collected near the shore unless boats are feasible and permitted. A small container or dipper attached to a pole is used to obtain the samples. Samples from various locations and depths should be composited; otherwise, separate samples will have to be collected. Approximate sampling points should be identified on a sketch of the water body. The following procedures are used:

1. Record available information for the pond, stream, or other water body, such as its size, location, depth, and probable contents, in the field logbook, on the chain-of-custody form, and on the sample log sheet.

2. Take samples near the shore of the water body and transfer them to appropriate bottles. See Table 4.29-3.

3. Secure the lid of each sample bottle and attach a label containing sample identification, number, and date. Securely tape the lid to the bottle; then date and initial the tape.

4. Measure the sample radioactivity and record. If readings exceed 10 mR/hr, notify the team leader or the site safety officer immediately.

5. Carefully pack samples. Custody-seal the shipping package and prepare a traffic report.

Ground Water

Monitoring Wells. Figure 4.29-1 is a typical well sampling data sheet. Not all the information shown can be obtained at all wells. Critical, required information includes

1. Well locations
2. Well radius or diameter

3. Depth to water level
4. Total well depth
5. Amount of water in well

This information should be entered in the logbook.

Wells must be bailed or pumped three to five well volumes before sampling. Samples are taken after the well recharges to initial water depth. Wells that do not recharge within 24 hours will be sampled after the well recharges to a sufficient depth to provide an adequate volume of sample for analysis. Care must be taken not to disturb sediment at the bottom of the well when taking samples. The following procedures are used:

1. Measure the water level in the well using an M-scope or other device and record the elevation at the top of the water surface.

2. Determine the submerged casing volume (standing water volume) in the well from the following equation:

$$V = \pi r^2 h$$

where

V = volume
r = radius
h = standing water height as determined from drilling logs and actual measurement.

For example, a 30-ft drilled well with 5 ft of screen has a 2-in. casing with a nominal inside diameter of 1.90 in. (4.83 cm). The standing water level has been determined to be 10 ft or approximately 305 cm. Therefore, the submerged casing volume (in cubic centimeters and liters)

$$= [3.14(2.42)^2]305$$
$$= 5609\ \text{cm}^3 \text{ or } 5.6 \text{ liters}$$

3. With a manual bailer, remove three to five casing volumes of water from the well. To avoid disturbing the sediment, do not insert the bailer to the bottom of the screen. (Note: If the casing size allows, the well may be pumped with a submersible electric pump or other device until the appropriate volume has been removed. Do not overpump.)

4. When the well has recharged sufficiently, remove enough water to fill all sample bottles in accordance with Table 4.29-3. Add preservatives where required. In the event that recovery time of the well is very slow (e.g., 24 hours), attempts to collect samples immediately after bailing or pumping can be delayed until the following day. If the well has been bailed early in the morning, sufficient water may be standing in the well by the day's end to

permit sample collection. If the well is incapable of producing a sufficient volume of sample at any time, take the largest quantity available and record in the logbook.

5. Label, tag, and number the sample bottle. Tape the lid on securely and mark the tape with the date and the collector's initials.
6. Replace the well cap. Make sure the well is readily identifiable as the source of the samples.
7. Pack the samples for shipping. Attach a custody seal to the shipping package as described above. Make sure that traffic reports and chain-of-custody forms are properly filled out and enclosed or attached.

Hydrants or Pumped Wells. Sampling from hydrants or pumped wells such as domestic wells requires a modified procedure. The well must be flushed by running the water for 5 minutes through the tap nearest the well. Take the sample from the continuously running tap after the 5-minute period. More detailed procedures can be found in Guideline 4.8.

Follow the steps above for entering information, packing, preserving, labeling, and marking.

Soils

Environmental soil sampling is generally performed off the site. The sampler to be used is dependent on soil type, depth of sample desired, and homogeneity of soil.

For loosely packed earth, the scoops, trowels, and waste pile samplers described above can be used to collect representative samples. For densely packed soils or deep soil samples, a soil auger or other techniques may be used.

1. Use a soil auger for deep samples (6 to 12 in.) or a scoop or trowel for surface samples. Remove debris, rocks, twigs, and vegetation before collecting 200 to 250 g. Mark the location with a numbered stake if possible and locate sample points on a sketch of the site.
2. Transfer 100 to 200 g of the sample to a 250-ml container. Attach a label, identification number, and tag. Record all required information in the field logbook and on the sample log sheet (see Figure 4.29-2).
3. Store the sampler in a plastic bag until decontamination or disposal.

4. Tape the lid on the sample bottle securely and mark the tape with the date and the sample collector's initials.

5. Carefully pack the samples. Attach a custody seal to the shipping package. Make certain that a traffic report and chain-of-custody forms are properly filled out and enclosed or attached.

Sludges and Sediments

Sludge samples and sediments can usually be collected by bucket or long-handled dipper. If the sludges or sediments are relatively dense, waste pile samplers or triers may be used.

1. Collect at least three small, equal-sized samples for several points along the sludge or sediment deposition area. If possible, mark the location with a numbered stake and locate sample points on a sketch of the site. Deposit sample portions in a clean, 1/2-gal wide-mouth jar. Carefully stir portions together into one composite.

2. Sediments from large streams, lakes, and the like may be taken with Ekman or Ponar dredges from a boat.

3. Transfer 100 to 200 g of the composite sludges from the 1/2-gal jar to a 250-ml sample bottle. Attach identification label number and tag. Record all necessary information in the field logbook and on the sample log sheet.

4. Store the sampler and jar in a plastic bag until decontamination or disposal.

5. Tape the lid on the sample bottle securely and mark the tape with the date and the sample collector's initials.

6. Pack the samples for shipping. Attach a custody seal to the shipping package. Make certain that a traffic report and chain-of-custody forms are properly filled out and enclosed or attached.

4.4.2 Hazardous Samples

Air

Air samples are rarely taken to determine medium or high hazard levels. In fact, site activities are usually suspended if high ambient hazardous substance concentrations are detected by routine monitoring devices or if low oxygen levels are discovered.

Surface Water

When collecting samples from medium- to high-hazard surface waters, such as onsite lagoons or ponds, the steps outlined above for environmental sampling should be followed. Added safety precautions, such as lifelines, are required.

Drums

Probably the most common container at hazardous waste sites is the drum, which is constructed of either metal or paper. Drum samples should be obtained through a free opening or through the bung hole whenever possible, using the procedure described below. Because drums may fail structurally, losing all or part of their contents, caution must always be exercised when it is necessary to move drums to gain access to them. The wisest course of action is to sample, analyze, and remove the most accessible drums before handling damaged, tipped, or buried drums. Remote-controlled bung wrenches are the best tools for opening drums.

Drums must be opened slowly and carefully. If the drum is bulging because of inside pressure or vacuum, special precautions must be taken in opening it.

It is permissible to place disposable sampling equipment in a drum that was sampled before resealing it. Separately labeled drums may be used as receptacles for contaminated sampling equipment as long as compatibility of the wastes is ensured.

The following procedures are used to obtain samples from drums:

1. Record any markings, special drum conditions, and type of opening in the field logbook, on the sample log sheet, and, later, on the chain-of-custody form. Locate the general area on a sketch of the site.

2. Stencil an identifying number on the drums and record in logbook. Consult the sampling plan for identifications.

3. Make certain that the drum is set on a firm base, preferably in a fully upright position.

4. Using a nonsparking bung wrench or a remote-controlled bung remover, carefully remove the bung and set it aside. Drums with top lids and snap-ring seals may be opened by carefully removing the seal and prying off the lid with a nonsparking tool. Set the lid and snap ring aside.

5. Carefully insert the sampling tube (either metal, glass, or compatible plastic) into the drum contents. Secure the upper end of the tube with the thumb or palm and withdraw the tube. (Note: If the sample is not free flowing and is contained in a drum with a lid, the sample may be removed with a clean scoop or a small shovel).

6. Deliver 100 to 250 ml of the sample (the sampling plan will specify the amount) to a clean, wide-mouth, 500-ml (1-pt) glass sample jar. If the sample is not free flowing and is taken through a bung opening, repeated sampling may be necessary. Replace the bung or cover carefully.

7. Place the used sampling tube, along with paper towels or waste rags used to wipe up any spills, into an empty metal barrel for subsequent disposal. If glass tubing has been used, it may be broken and left inside the drum being sampled.

8. Replace the cap on the sample jar; label, date, and number the jar. Record all information on the chain-of-custody form, sample log sheet, sample tag, and field logbook. The sample jar numbers and dates must match those recorded on all forms.

9. Secure the sample container lid with heavy-duty tape. Date and sign the tape.

10. Measure the sample for radioactivity. If the meter readings exceed 10 mR/hr, notify the site manager immediately.

11. Carefully pack samples. The finished package will be padlocked or custody-sealed for shipment to the laboratory. The preferred procedure includes the use of a custody seal wrapped across filament tape that is wrapped around the package at least twice. The custody seal (paper, plastic, or metal) is then folded over and stuck to itself so that the only access to the samples is by cutting the filament tape or breaking the seal to unwrap the tape. The seal is signed before the package is shipped.

12. Complete the appropriate traffic report. Drum samples are always considered to be high-hazard samples.

More detailed procedures are provided in Guideline 4.28 on drum opening and sampling.

Tanks

The sampling of tanks is similar to the sampling of drums. Techniques of sampling are the same, except sampling equipment may need to be longer to give a representative sample of deep tanks.

1. Record the tank's condition, markings, opening or valve types, and approximate size in gallons in the field logbook, on the chain-of-custody form, and on the sample log sheet. Note the tank location on the site sketch.

2. Attach an identification number to the tank using a stencil or weatherproof tag. Number succeeding tanks consecutively. Record the numbers in the logbook.

3. Determine whether the tank contents are stratified by inserting a long plastic or glass tube sampler, withdrawing it, and examining the tube contents.

4. Samples of stratified contents can be taken with a bomb or weighted bottle sampler at each level. A segmented tube sampler may also be used if available. Deliver sampler contents, if stratified, to separate 500-ml glass sample jars. Otherwise, a single sample will suffice.

5. Secure the jar lid and label, date, and number the jar as above. Securely tape the lid to the jar; date and initial the tape.

6. Measure the sample radioactivity and record. Notify the site manager if readings exceed 10 mR/hr.

7. Carefully pack samples. Custody-seal the shipping package as described previously.

8. Clean any nondisposable sampling equipment and dispose of cleaning solvents and materials in a metal drum. Wipe up any spills and place rags or paper towels in the metal drum for later disposal.

9. Complete a high-hazard traffic report.

Solid Waste Piles

Piles of waste usually vary in size and composition. Use scoops or trowels to obtain small discrete samples of homogeneous piles. Layered (nonhomogeneous) piles require the use of tube samplers or triers to obtain cross-sectional samples.

1. Collect small, equal portions of the waste from several points at or near the surface of the pile. Use numbered stakes, if possible, to mark the sampling locations and locate sampling points on the site sketch.

2. Collect a waste sample totaling 100 to 200 g and place it in a 250-ml glass container. Attach a label, identification number, and tag. Record all the required information in the field logbook and on the sample log sheet.

3. Store the sampling tool in a plastic bag until decontamination or disposal.

4. Tape the lid on the sample bottle securely and mark the tape with the date and the sample collector's initials.

5. Pack samples for shipping. Attach a custody seal to the shipping package. Make sure that the traffic report and the chain-of-custody form are properly filled out and enclosed or attached.

For layered, nonhomogeneous piles, grain samplers, sampling triers, or waste pile samplers must be used to acquire a cross-section of the pile. The basic steps are listed below.

1. Insert a sampler into the pile at a 0- to 45-degree angle from the horizontal to minimize spillage.
2. Rotate the sampler once or twice to cut a core of waste material. Rotate the grain sampler inner tube to the open position and then shake the sampler a few times to allow the material to enter the open slits.
3. Move the sampler into position with slots upward (grain sampler closed) and slowly withdraw it from the pile.
4. Transfer 100 to 200 g of sample into a 250-ml container with the aid of a spatula or brush. Attach a label identification number and tag. Record all necessary information in the field logbook and on the sample log sheet.
5. Store the sampler in a plastic bag until decontamination or disposal.
6. Tape the lid on the sample bottle securely and mark the tape with the date and the sample collector's initials.
7. Pack samples for shipping. Attach a custody seal to the shipping package. Make certain that the traffic report and chain-of-custody form are properly filled out and enclosed or attached.

Soils

Guidelines for collecting hazardous soil samples are the same as those for collecting environmental soil samples.

Sludges and Sediments

Guidelines for collecting hazardous sludge and sediment samples are the same as those for collecting environmental sludge and sediment samples.

4.5 SAMPLING DOCUMENTS AND RECORDS

This section identifies the various documents, forms, labels, and tags that sampling personnel will be required to use in the field. Most of the forms and labels have been standardized, thus providing for consistency of documentation.

- Field logbook(s)
- Field data records
  - Sample log sheet
  - Table of contents for sample log sheet notebook
  - Other

- Sample labels
  - Sample identification label
  - Traffic report label
- Sample identification tag
- Chain-of-custody form
- Traffic reports
  - Organic
  - Inorganic
  - High hazard
- Custody seal

There are additional forms of documentation that may need to be maintained that are not standard in format. These forms are discussed separately. Detailed descriptions of each of the forms are provided in the Superfund Training Manual.

4.5.1 Field Logbook

A field logbook is a bound notebook with numbered pages in which all pertinent information about a field investigation (data, observations, phone calls, etc.) is entered. One field logbook is maintained per site. This logbook is issued by the Regional Project Manager (or his designee) to the Project Manager for the life of the project. In addition, logbooks may be issued to other field personnel (including those collecting samples). The document custodian numbers all logbooks and records the transfer of other logbooks to individuals designated by the Regional Project Manager. All project logbooks are to be turned over to the document custodian and to a central file at the completion of the particular field activity.

4.5.2 Field Data Records

Field data records may include sample log sheets, tables of contents for sample log sheet notebooks, and any other data records that the Project Manager or task leader may designate for use in field data collection. The exact forms used will depend on the scope of the project and the situations presented.

4.5.3 Sample Log Sheet

A sample log sheet is a notebook page 8.5 by 11 in. that is used to record specified types of data while sampling. Figure 4.29-2 is an example of a sample log sheet. The data recorded on these sheets is useful in describing the waste source and the sample (if obtained) as well as pointing out any problems encountered during sampling. Blank sample log sheets may be obtained from the document custodian; these forms are not controlled documents.

4.5.4 Table of Contents for Sample Log Sheet Notebook

The table of contents form is a notebook page 8.5 by 11 in. on which entries are made as the completed sample log sheets are placed in a three-ring binder. Figure 4.29-3 is an example of the table of contents form. This form facilitates quick reference to the sample log sheets contained in the notebook and remains in the notebook at all times. Blank table of contents forms may be obtained from the document custodian. These forms are not controlled documents and therefore do not bear a sequential serial number.

4.5.5 Labeling of Samples

NUS Sample Label

The sample label is a 2- by 4-in. white label with black lettering and an adhesive backing. Figure 4.29-4 is an example of an NUS sample identification label. Blank labels may be obtained from the document custodian when needed. These labels are controlled documents.

A sample label must be attached to each bottle that contains a sample. The label must be attached to the bottle just before putting the sample into the bottle. In addition, the label should be covered with clear plastic tape to ensure that it does not peel off or become damaged. The NUS sample number is the number assigned to the waste source under inspection and any samples taken from it.

Traffic Report Label

The traffic report label is a small prenumbered white label with black lettering and an adhesive backing. Figure 4.29-5 provides examples of several traffic report labels. This label must be attached to the appropriate sample bottle before shipping it to the designated laboratory. Traffic report labels come attached to the traffic reports. Any unused labels must be returned to the document custodian and eventually to EPA's Sample Management Office.

The number which appears on a traffic report label is the same number that appears in the upper left-hand corner of the traffic report. In addition to the number, each label contains a designation as to the type of analysis to be performed (VOA, etc.) or as to preservation of the sample (preserved, unpreserved, etc.). No additional information need be entered on the label.

4.5.6 Sample Identification Tag

The sample identification tag is a heavy paper tag (6 by 2.5 in.) with a wire fastener. It is attached to the top of a sample bottle before shipping. An example of a sample identification tag is presented in Figure 4.29-6. These tags, together with the NUS sample labels, serve to identify the sample. Blank tags may be obtained from the document custodian when needed. These tags are controlled documents.

4.5.7 Chain-of-Custody Form

The chain-of-custody form (8.5 by 11 in.) accompanies a sample or group of samples as it is transferred from person to person. Figure 4.29-7 is an example of a chain-of-custody form. This form documents custody transfer from person to person. The chain-of-custody form is a controlled document. Blank forms may be obtained from the document custodian when needed.

4.5.8 Traffic Reports

A traffic report is a preprinted, prenumbered form (8.5 by 11 in.) that is provided by the EPA's Sample Management Office. These forms are part of the EPA's sample-tracking system and are used to trace the shipment of samples for laboratory analysis. Presently, these forms are for three types of samples: organics, inorganics, and high hazard (see Figures 4.29-8, 4.29-9, and 4.29-10, respectively). The organics and inorganics forms are used to document and identify the collection of low- and medium-concentration samples for organic and inorganic analysis; the high-hazard form is for high-concentration samples. Traffic reports are controlled documents that are maintained by the document custodian.

The person doing the sampling completes a traffic report for each sample that is to be shipped for laboratory analysis. These forms are simple enough and the instructions sufficiently clear that a detailed procedure for filling them out is not warranted.

Sampling personnel should use the proper traffic report form for each sample collected. Environmental samples must always be submitted on the regular organics or inorganics traffic report, while most hazardous waste samples require the use of the high-hazard traffic report. The regular traffic report forms ask the sampler to indicate low or medium concentration. Environmental samples (ground water, streams, offsite ditches, springs, or wells, as well as offsite soil samples) are classified as being of low concentration. The most likely medium-concentration sources are leachate collection pools, onsite impoundments, and onsite ditches. Soils from spoil banks or adjacent to onsite storage areas are also likely to have a medium concentration of pollutants. Site sampling plans should be used as a guide in assessing likely conditions.

4.5.9 Custody Seal

A custody seal is a 1- by 3-in. white paper label with black lettering on an adhesive backing. Figure 4.29-11 is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals are provided by the Sampling Management Office and are distributed by the document custodian on an as-needed basis.

4.5.10 Nonstandard Documentation

Shipping Documents

A shipping document will have to be completed for each shipment of samples. These forms will be provided by the carrier at the time of shipments. The form should be completed as directed and should include the appropriate sample identification numbers (NUS sample source number and traffic report number). An example of a typical shipping form is provided in Figure 4.29-12. This form also provides certification to the carrier that the samples are identified, packaged, and presented for shipment in accordance with U.S. Department of Transportation regulations.

Photographs

When movies, slides, or photographs are taken of a site or any monitoring location, they are numbered to correspond to logbook entries. The name of the photographer, date, time, site location, site description, and weather conditions are entered in the logbook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook. If possible, such techniques should be avoided, since they can adversely affect the admissibility of photographs as evidence. Chain-of-custody procedures depend upon the subject matter, type of film, and the processing it requires. Film used for aerial photography, confidential information, or criminal investigations require chain-of-custody procedures. Adequate logbook notations and receipts may be used to account for routine film processing. Once developed, the slides or photographic prints shall be serially numbered and labeled according to the logbook descriptions.

142A

Table 4.29-1. Instrumentation for Air Monitoring

Hazard	Direct Reading	Instrument Type/Name	Collection Media
Explosive atmosphere	Combustible gas indicator	MSA-2A	Not used
Oxygen-deficient atmosphere	Oxygen meter	MSA-245R	Not used
Toxic atmosphere	Photoionization detector, flame ionization detector with gas chromatography option, colorimetric tubes	HNU-PI-101, OVA-Century, OVA 108, Drager, Bendix, MSA	Sampling pumps in conjunction with gas chromatograph, absorption tubes, filters, impingers
Radioactivity	Radiation survey meters (Geiger-Mueller), passive monitors	Eberline, Victoreen	Dosimeters, film badges

Table 4.29-2. Solid and Liquid Sampling Equipment

Sampler	Applications	Limitations
Plastic[a]	Liquids, slurries	Not for wastes containing ketones, nitrobenzene, dimethylformamide, mesityl oxide, tetrahydrofuran, or many common solvents such as acetone.
Glass tubes[a]	--	Not for wastes containing hydrofluoric acid and concentrated alkali solutions.
Pumps, bailers	Wells	Pump may be used for precleaning well. Power or gas sources required. Bailers are slower than pumps, require no tubing.
Pond (dip) sampler[a]	Liquids, sludges	Cannot be used to collect samples beyond 12 ft.
Manual hand pump	Liquids	Requires large amounts of disposable tubing; cannot be used when tubing is not compatible with material.
Weighted bottle sampler	Liquids	Difficult to use with very viscous liquids. Exterior of sample bottle is exposed to hazardous materials.
Buckets	Streams, ponds	Restricted to onshore sampling.
Grain sampler	Granular solids	Limited application for sampling moist and sticky solids with a diameter of 1/4 in.
Sampling trier	Solids	May incur difficulty in retaining core sample of very dry granular materials during sampling.
Trowel/scoop/spoon[a]	Solids, soil	Not applicable to sampling deeper than 3 in. Difficult to obtain reproducible mass of samples.
Wisk pile sampler	Loose solids	Not applicable to sampling solid wastes with dimensions greater than half the diameter of the sampling tube.
Soil auger (manual)	Soil deeper than 3 to 4 in.	Does not collect undisturbed core sample.

[a] Recommended devices.

Table 4.29-3. Container and Preservation Requirements

Type of Sample[a]	Concentration[b]	Sample Container	Sample Size	Preservatives
		Liquids		
GC and GC/MS	Low	1/2 gal glass	1 gal	Ice
organics		40-ml glass ampule	80 ml	Ice
Extractables				
VOAs	Medium and High	8-oz glass	4 to 6 oz	None
Inorganics	Low	1-liter polyethylene	1 liter[c]	NEIC[c]
	Medium	8-oz glass	4 oz	None
	High	8-oz glass	4 oz	None
General chemistry		1-liter polyethylene	1 liter	None
COD/TOC		1-liter polyethylene	0.5 liter	H_2SO_4 to pH ≤ 2
Cyanide		1/2-liter polyethylene	0.5 liter	NaOH to pH ≥ 12
Oil and grease		1-liter glass	1.0 liter	H_2SO_4 to pH ≤ 2
Phenols		1-liter polyethylene	1.0 liter	1 g/liter of copper sulfate H_3PO_4 to pH ≤ 4
Sulfides		1/2-liter glass	0.5 liter	2-ml of 2N zinc acetate solution/liter
		Soils/Solids		
GC and GC/MS	Low	8-oz glass	6 oz	None
organics	Medium	4-oz glass	3 oz	None
	High	8-oz glass	4 oz	None
Inorganics	Low	4-oz glass	3 oz[c]	NEIC[c]
	Medium	4-oz glass	3 oz	None
	High	8-oz glass	4 oz	None

---

[a] GC = gas chromatography; MS = mass spectroscopy; COD/TOC = Chemical Oxygen Demand/Total Organic Carbon.

[b] Low = sample contains less than 10 ppm of any single contaminant; medium = sample contains between 10 ppm and 15 percent of any one contaminant; high = sample contains greater than 15 percent of any one contaminant.

[c] See NEIC requirements in NEIC Denver's Enforcement Considerations for Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors, April 1980.

Well-Monitoring Data Sheet

Waste Site Name ____________________ Analyze for:

Waste Site Location ________________

____

____

Well I.D.# ____________________

Sampler ____________________

Date and Time ____________________

Sample I.D.# ____________________

Well Depth ____________________

Water Depth ____________________

Casing Size ____________________

Volume Bailed ____________________

Recharge Wait ____________________

Depth Sampled ____________________

Sample Method

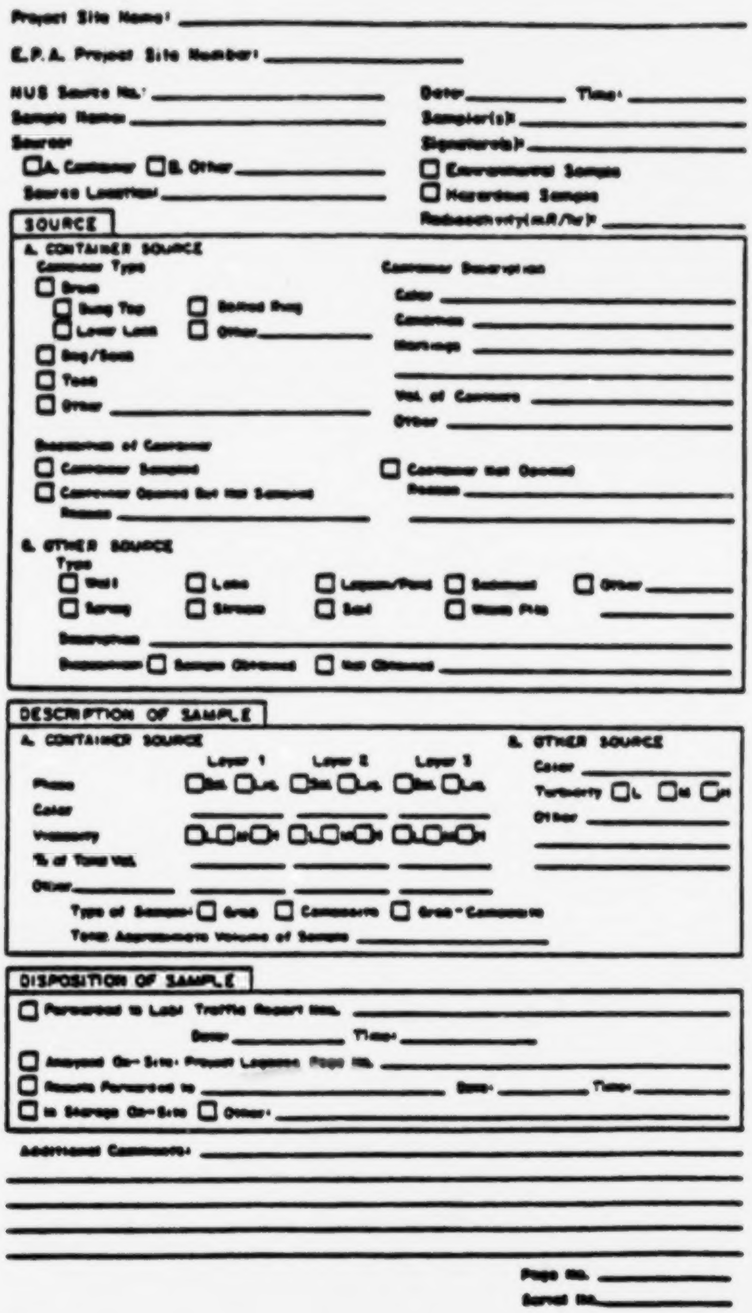
- Vacuum
- Bailer
- Pressure
- Other

Sample Temperature ________________

Preservation Method ________________

Observations ________________

Figure 4.29-1. Example of Well-Monitoring Data Sheet



Project Site Name: ______________________

E.P.A. Project Site Number: ______________

NUS Source No.: ______________ Date: __________ Time: __________
Sample Name: ______________ Sampler(s): ______________
Source: Signature(s): ______________
☐ A. Container ☐ B. Other ________ ☐ Environmental Sample
Source Location: ______________ ☐ Hazardous Sample
Radioactivity(mR/hr): __________

SOURCE

A. CONTAINER SOURCE

Container Type
☐ Drum
  ☐ Bung Top ☐ Bolted Ring
  ☐ Lever Lock ☐ Other ________
☐ Bag/Sack
☐ Tank
☐ Other ______________

Container Description
Color ______________
Condition ______________
Markings ______________
____
Vol. of Contents ______________
Other ______________

Disposition of Container
☐ Container Sampled
☐ Container Opened But Not Sampled
Reason ______________
☐ Container Not Opened
Reason ______________
____

B. OTHER SOURCE

Type
☐ Well ☐ Lake ☐ Lagoon/Pond ☐ Sediment ☐ Other ________
☐ Spring ☐ Stream ☐ Soil ☐ Waste Pile ________
Description ______________________
Disposition ☐ Sample Obtained ☐ Not Obtained ______________

DESCRIPTION OF SAMPLE

A. CONTAINER SOURCE

	Layer 1	Layer 2	Layer 3
Phase	☐ Sol. ☐ Liq.	☐ Sol. ☐ Liq.	☐ Sol. ☐ Liq.
Color	________	________	________
Viscosity	☐ L ☐ M ☐ H	☐ L ☐ M ☐ H	☐ L ☐ M ☐ H
% of Total Vol.	________	________	________
Other ________	________	________	________

B. OTHER SOURCE
Color ______________
Turbidity ☐ L ☐ M ☐ H
Other ______________
____
____

Type of Sample: ☐ Grab ☐ Composite ☐ Grab-Composite
Total Approximate Volume of Sample ______________

DISPOSITION OF SAMPLE

☐ Forwarded to Lab: Traffic Report No. ______________
Date: __________ Time: __________
☐ Analyzed On-Site: Project Logbook Page No. ______________
☐ Results Forwarded to ______________ Date: __________ Time: __________
☐ In Storage On-Site ☐ Other: ______________

Additional Comments: ______________________
____
____
____
____

Page No. __________
Serial No. __________

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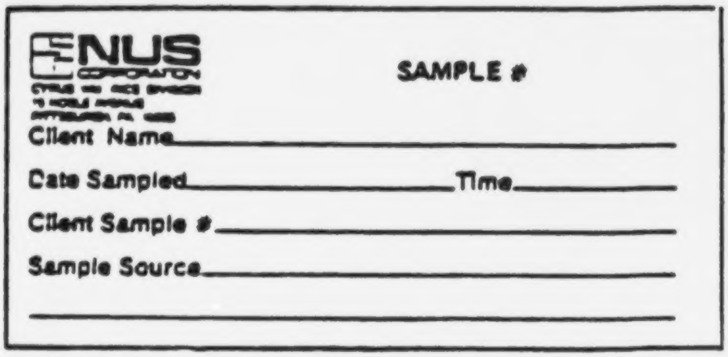
Figure 4.29-2. Example of Sample Log Sheet

SAMPLE LOG NOTEBOOK
TABLE OF CONTENTS

SAMPLE NUMBER	DATE SAMPLED	SAMPLE NAME	PAGE NO.

Figure 4.29-3. Example of Table of Contents for Sample Log Notebook



NUS CORPORATION

SAMPLE #

Client Name____________________________

Date Sampled________________Time__________

Client Sample #__________________________

Sample Source__________________________

Figure 4.29.4. Example of NUS Sample Label

Organics

A 1453 . -Water
(Ext & VOA)

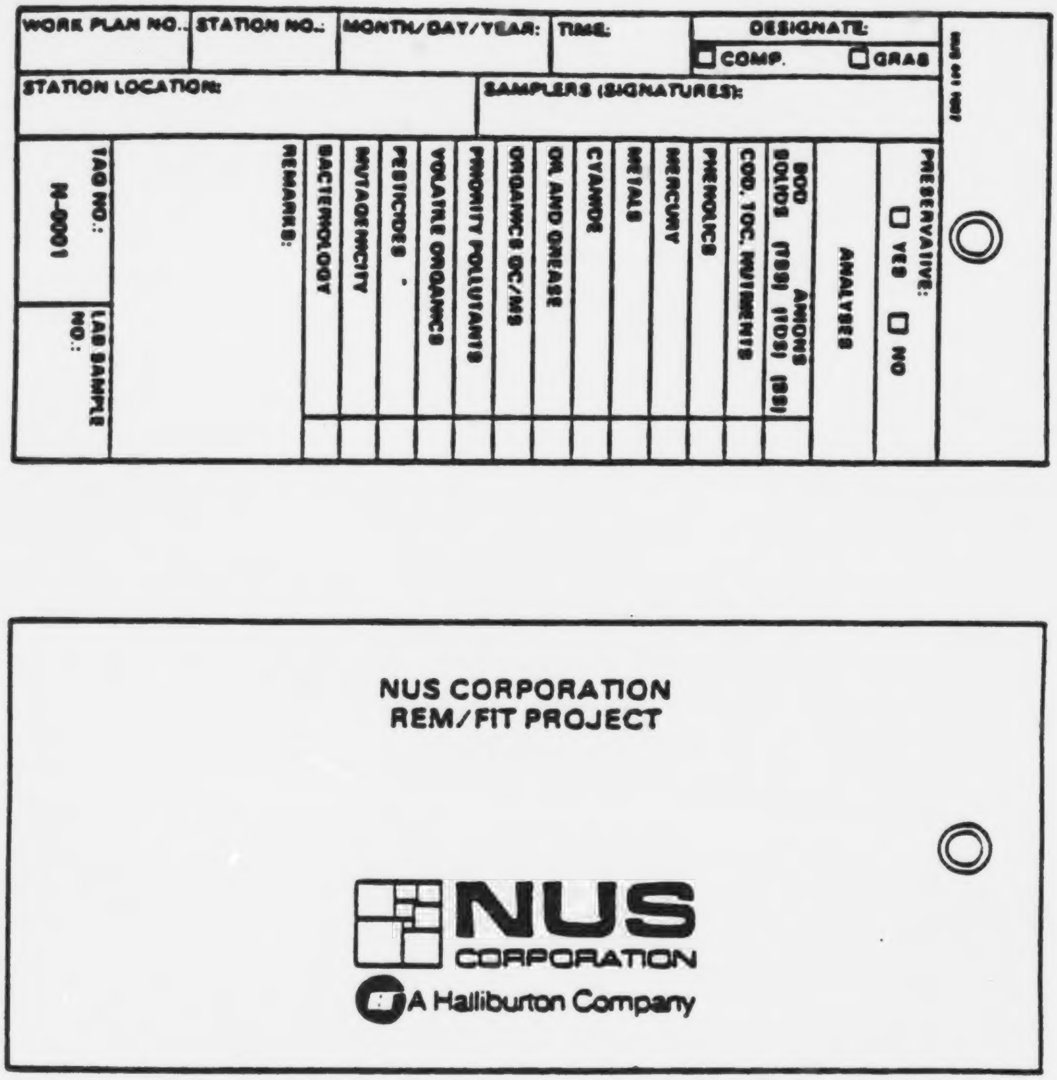
Inorganics

MA 9104 -Task 3

High Hazard

A 5154

Figure 4.29-5. Examples of EPA Traffic Report Labels

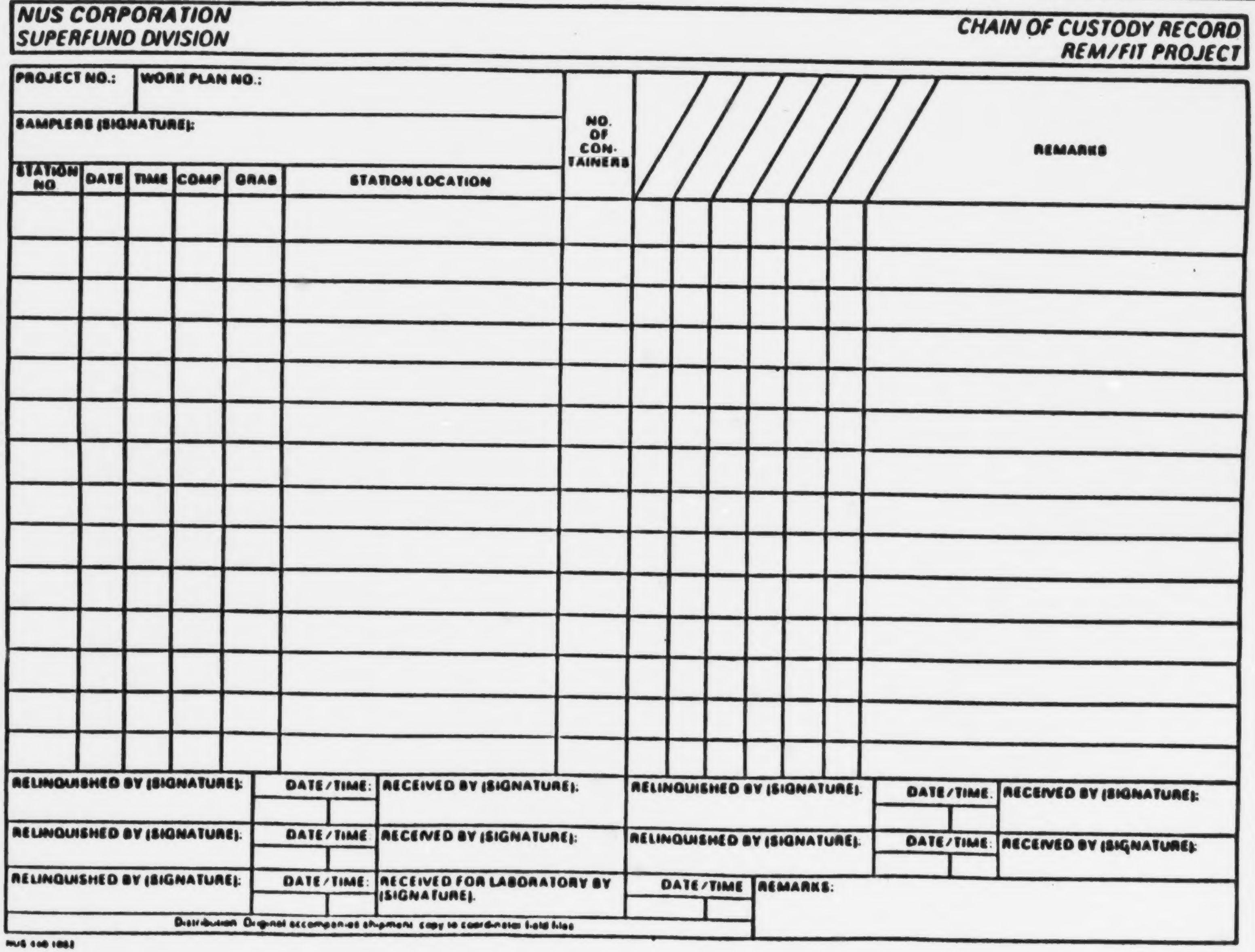


WORK PLAN NO.:
STATION NO.:
MONTH/DAY/YEAR:
TIME:
DESIGNATE: ☐ COMP. ☐ GRAB
STATION LOCATION:
SAMPLERS (SIGNATURES):
TAG NO.: N-0001
LAB SAMPLE NO.:
REMARKS:
BACTERIOLOGY
MUTAGENICITY
PESTICIDES
VOLATILE ORGANICS
PRIORITY POLLUTANTS
ORGANICS GC/MS
OIL AND GREASE
CYANIDE
METALS
MERCURY
PHENOLICS
COD, TOC, NUTRIENTS
BOD AMONIS SOLIDS (TSS) (TDS) (SS)
ANALYSES
PRESERVATIVE: ☐ YES ☐ NO

NUS CORPORATION
REM/FIT PROJECT

NUS CORPORATION
A Halliburton Company

Figure 4.29-6. Example of Sample Identification Tag



NUS CORPORATION
SUPERFUND DIVISION

CHAIN OF CUSTODY RECORD
REM/FIT PROJECT

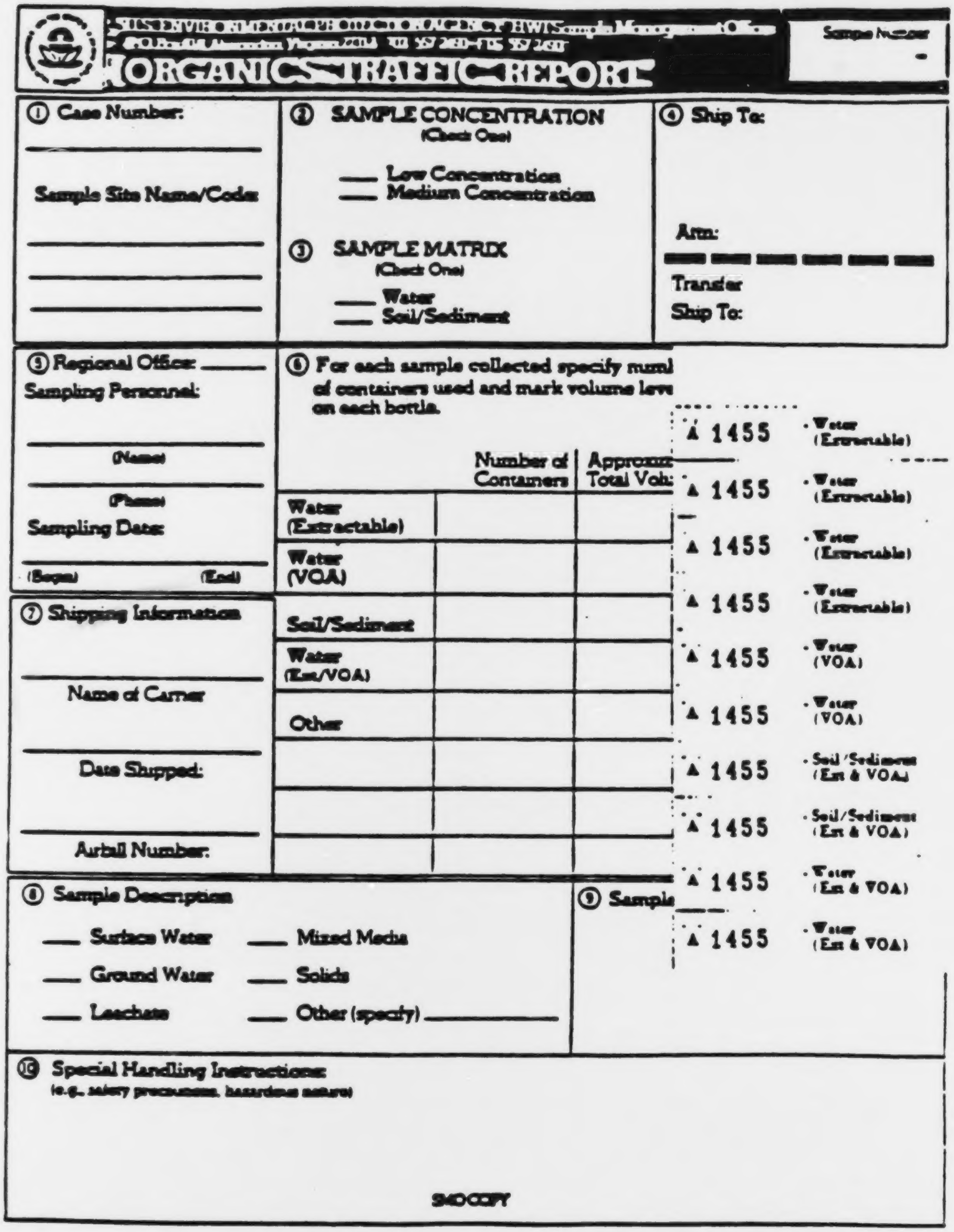
PROJECT NO.:
WORK PLAN NO.:
SAMPLERS (SIGNATURE):

STATION NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS							REMARKS

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME	REMARKS:	

Distribution: Original accompanies shipment; copy to coordinator field files

Figure 4.29-7. Example of Chain of Custody Form



U.S. ENVIRONMENTAL PROTECTION AGENCY HWI Sample Management Office
P.O. Box 818 Alexandria, Virginia 22313 703 557 2490 FTS 557 2490

ORGANICS TRAFFIC REPORT

Sample Number
-

① Case Number: ____

Sample Site Name/Code: ____

② **SAMPLE CONCENTRATION**
(Check One)
___ Low Concentration
___ Medium Concentration

③ **SAMPLE MATRIX**
(Check One)
___ Water
___ Soil/Sediment

④ Ship To:

Attn:

Transfer
Ship To:

⑤ Regional Office: ____
Sampling Personnel:
____ (Name)
____ (Phone)
Sampling Date:
____ (Begin) (End)

⑥ For each sample collected specify num
of containers used and mark volume leve
on each bottle.

	Number of Containers	Approxim Total Vol
Water (Extractable)		
Water (VOA)		
Soil/Sediment		
Water (Ext/VOA)		
Other		

▲ 1455 · Water (Extractable)
▲ 1455 · Water (Extractable)
▲ 1455 · Water (Extractable)
▲ 1455 · Water (Extractable)
▲ 1455 · Water (VOA)
▲ 1455 · Water (VOA)
▲ 1455 · Soil/Sediment (Ext & VOA)
▲ 1455 · Soil/Sediment (Ext & VOA)
▲ 1455 · Water (Ext & VOA)
▲ 1455 · Water (Ext & VOA)

⑦ Shipping Information
____ Name of Carrier
____ Date Shipped:
____ Airbill Number:

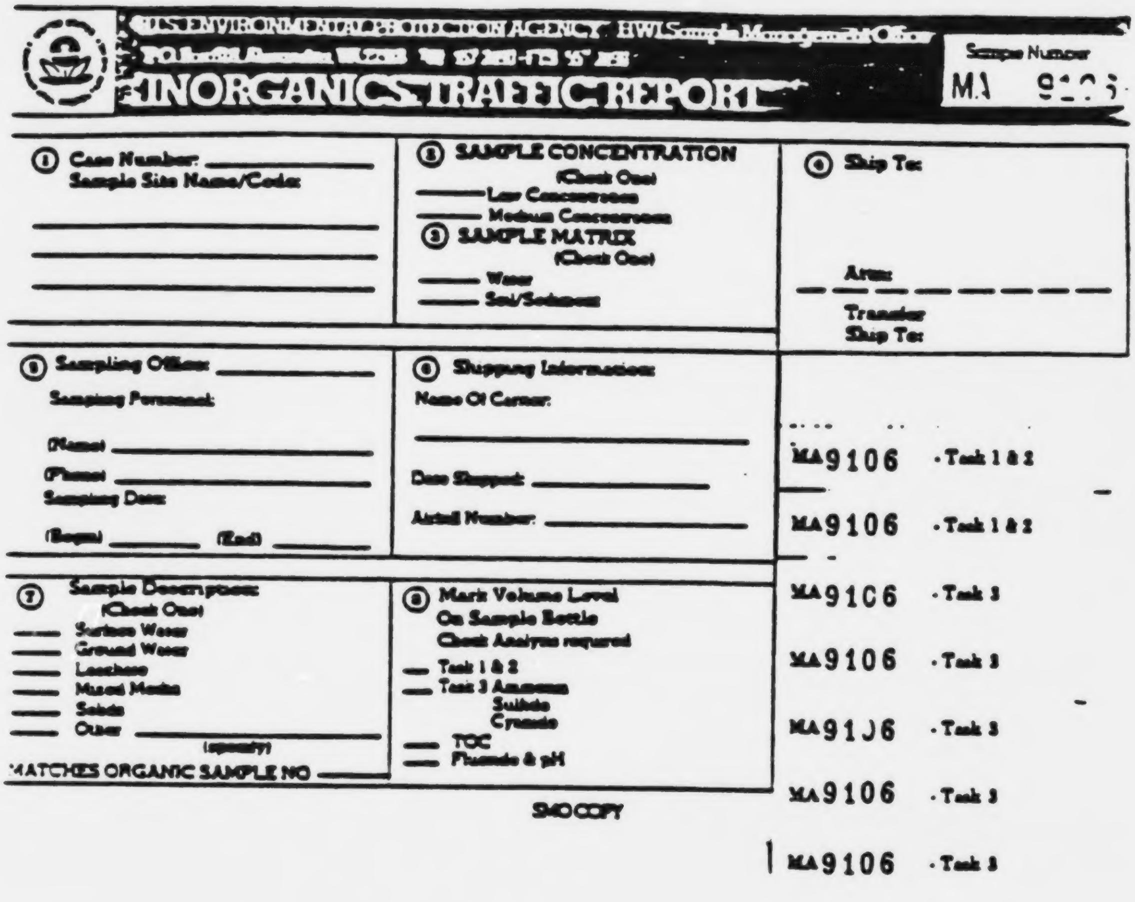
⑧ Sample Description
___ Surface Water ___ Mixed Media
___ Ground Water ___ Solids
___ Leachate ___ Other (specify) ____

⑨ Sample

⑩ Special Handling Instructions:
(e.g., safety precautions, hazardous nature)

SMO COPY

Figure 4.29-8. Example of Organics Traffic Report



U.S. ENVIRONMENTAL PROTECTION AGENCY HWI Sample Management Office
[illegible]

INORGANICS TRAFFIC REPORT

Sample Number
MA 9106

① Case Number: ____
Sample Site Name/Code:

② SAMPLE CONCENTRATION
(Check One)
____ Low Concentration
____ Medium Concentration

③ SAMPLE MATRIX
(Check One)
____ Water
____ Soil/Sediment

④ Ship To:

Attn:

Transfer
Ship To:

⑤ Sampling Office: ____
Sampling Personnel:
(Name) ____
(Phone) ____
Sampling Date:
(Begin) ____ (End) ____

⑥ Shipping Information:
Name Of Carrier:
____
Date Shipped: ____
Airbill Number: ____

⑦ Sample Description
(Check One)
____ Surface Water
____ Ground Water
____ Leachate
____ Mixed Media
____ Solids
____ Other ____
(specify)

MATCHES ORGANIC SAMPLE NO ____

⑧ Mark Volume Level
On Sample Bottle
Check Analysis required
__ Task 1 & 2
__ Task 3 Ammonia
Sulfide
Cyanide
__ TOC
__ Fluoride & pH

SMO COPY

MA9106 · Task 1 & 2

MA9106 · Task 1 & 2

MA9106 · Task 3

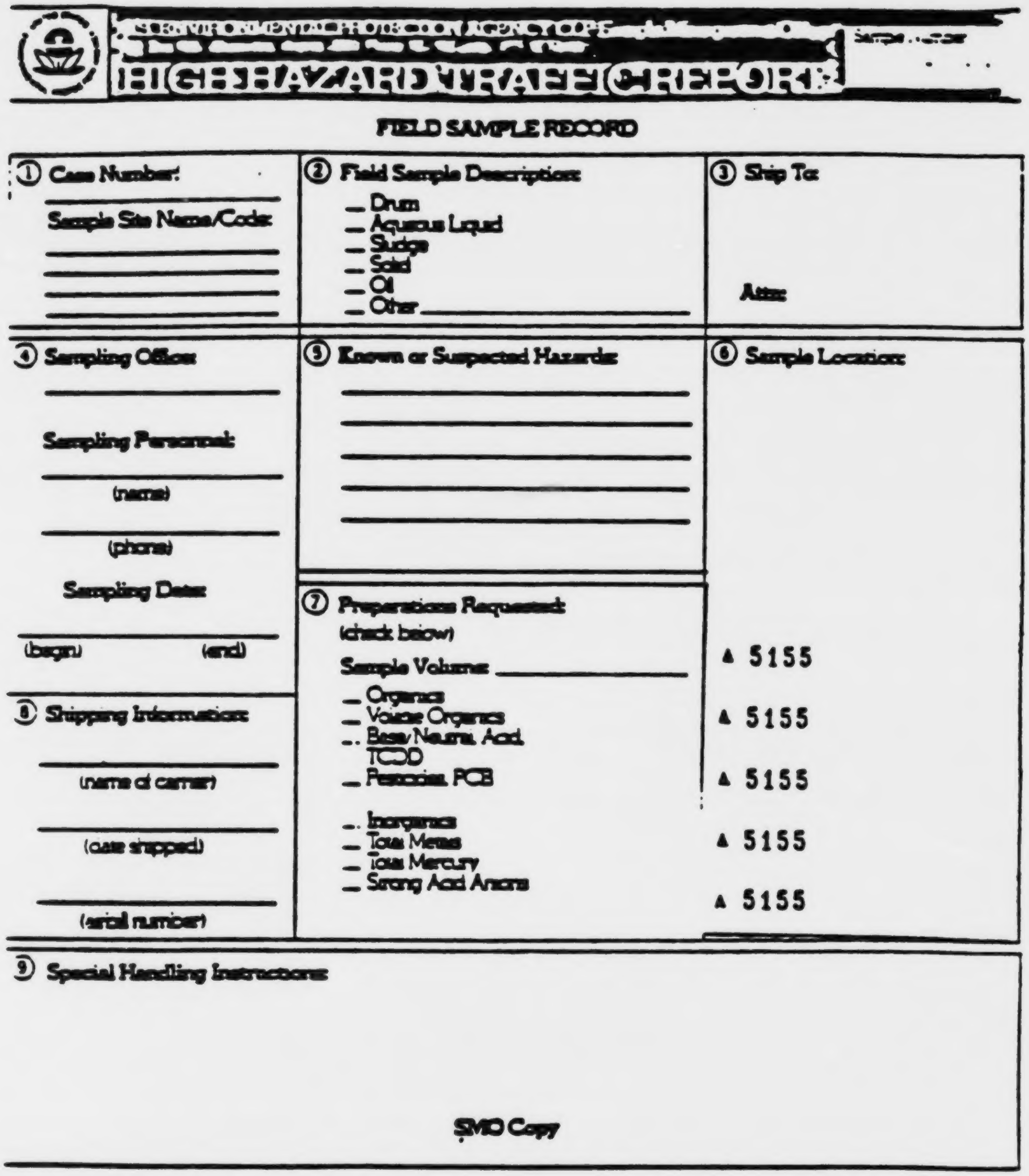
MA9106 · Task 3

MA9106 · Task 3

MA9106 · Task 3

MA9106 · Task 3

Figure 4.29-9. Example of Inorganics Traffic Report



US ENVIRONMENTAL PROTECTION AGENCY CLP [illegible]

[illegible]

Sample Number

HIGH HAZARD TRAFFIC REPORT

FIELD SAMPLE RECORD

① Case Number:

Sample Site Name/Code:

② Field Sample Description:

- __ Drum
- __ Aqueous Liquid
- __ Sludge
- __ Solid
- __ Oil
- __ Other ________

③ Ship To:

Attn:

④ Sampling Office:

Sampling Personnel:

(name)

(phone)

Sampling Date:

(begin) (end)

⑤ Known or Suspected Hazards:

⑥ Sample Location:

⑦ Preparations Requested:
(check below)

Sample Volume: ________

- __ Organics
- __ Volatile Organics
- __ Base/Neutral, Acid, TCDD
- __ Pesticides, PCB
- __ Inorganics
- __ Total Metals
- __ Total Mercury
- __ Strong Acid Anions

▲ 5155

▲ 5155

▲ 5155

▲ 5155

▲ 5155

⑧ Shipping Information:

(name of carrier)

(date shipped)

(serial number)

⑨ Special Handling Instructions:

SMO Copy

Figure 4.29-10. Example of High-Hazard Traffic Report

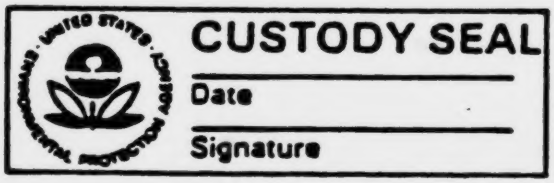
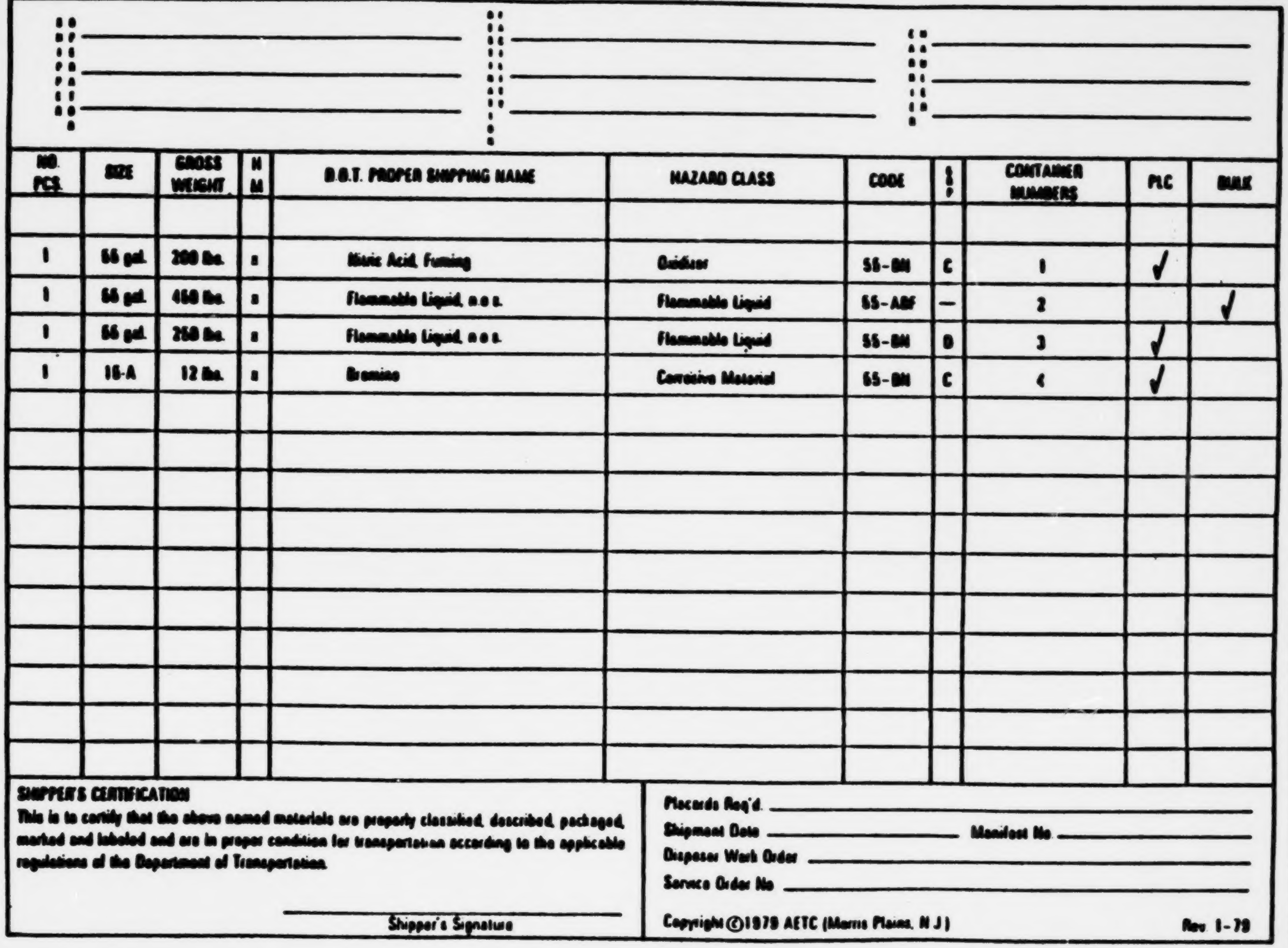

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CUSTODY SEAL
Date
Signature

Figure 4.29-11. Example of EPA Chain-of-Custody Seal



NO. PCS.	SIZE	GROSS WEIGHT	H M	D.O.T. PROPER SHIPPING NAME	HAZARD CLASS	CODE	S O P	CONTAINER NUMBERS	PLC	BULK
1	55 gal.	200 lbs.	x	Nitric Acid, Fuming	Oxidizer	55-BM	C	1	✓	
1	55 gal.	460 lbs.	x	Flammable Liquid, n.o.s.	Flammable Liquid	55-ABF	—	2		✓
1	55 gal.	250 lbs.	x	Flammable Liquid, n.o.s.	Flammable Liquid	55-BM	D	3	✓	
1	15-A	12 lbs.	x	Bromine	Corrosive Material	55-BM	C	4	✓	

SHIPPER'S CERTIFICATION

This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Shipper's Signature

Placards Req'd. __________

Shipment Date __________ Manifest No. __________

Disposer Work Order __________

Service Order No __________

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Figure 4.29-12. Example of Sample Shipping Document

APPENDIX E

NUS HEALTH AND SAFETY PLAN

TASK-SPECIFIC HEALTH AND SAFETY PLAN
FOR
LEACHATE SAMPLING OF MUNICIPAL LANDFILLS
UNDER
RCRA WORK ASSIGNMENT NO. 4
FOR
VAN DAL SITE, DURANGO, COLORADO
SHORT MOUNTAIN SITE, GOSHEN, OREGON
PORTAGE COUNTY LANDFILL, STEVEN'S POINT, WISCONSIN

NUS PROJECT NO. Y950

Written by: John D. 1/22/87

Approved by: Matthew M. 1/30/87

LEACHATE SAMPLING
Project Name: RCRA WORK ASSGN. # 4 Project No. Y950

Scope of Work and Purpose of Visit:

Leachate sampling from surface impoundments and manholes. Leachate will be pumped from manholes or sampled using bailers or buckets.

Site Visit Personnel:	Responsibility
Denise Taylor	Sampler - Team leader
Terry Rejahn	Sampler - H&S followup report

(Personnel must meet training and medical requirements)
(Medical sheets attached)

Other Contacts	Phone Nos.
George Van Den Berg (VP landfill)	303-247-2546
Gerri Dorran (EPA)	202-382-4688
Susan Heaney (EPA)	202-382-4895
Mike Turner (SM Landfill)	503-687-4119
Mike Stemple (PC Landfill)	715-592-4663

American Red Cross

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First Aid

EMERGENCY TELEPHONE NUMBERS

Police
Fire Department See Site (in K
Doctor Fitd
Ambulance
Hospital
Poison Control Center

BITES Animal Bites - Thoroughly wash the wound with soap and water. Flush the area with running water and apply a sterile dressing. Immobilize affected part until the victim has been attended by a physician. See that the animal is kept alive and in quarantine. Obtain name and address of the owner of the animal.

Insect Bites - Remove "stinger" if present. Keep affected part down below the level of the heart. Apply ice bag. For minor bites and stings apply soothing lotions, such as calamine.

BURNS AND SCALDS Minor Burns - DO NOT APPLY VASELINE OR GREASE OF ANY KIND. Apply cold water applications until pain subsides. Cover with a dry, sterile gauze dressing. Do not break blisters or remove tissue. Seek medical attention.

Severe Burns - Do not remove adhered particles of clothing. Do not apply ice or immerse in cold water. Do not apply ointment, grease or vaseline. Cover burns with thick sterile dressings. Keep burned feet or legs elevated. Seek medical attention immediately.

Chemical Burns - Wash away the chemical soaked clothing with large amounts of water. Remove victim's chemical soaked clothing. If dry lime, brush away before flushing. Apply sterile dressing and seek medical attention.

CRAMPS Symptoms - Cramps in muscles of abdomen and extremities. Heat exhaustion may also be present.

Treatment - Same as for heat exhaustion.

CUTS Apply pressure with sterile gauze dressing, and elevate the area until bleeding stops. Apply a bandage and seek medical attention.

EYES Foreign Objects - Keep the victim from rubbing his his eye. Flush the eye with water. If flushing fails to remove the object, apply a dry, protective dressing and consult a physician.

Chemicals - Flood the eye thoroughly with water for 15 minutes. Cover the eye with a dry pad and seek medical attention.

FAINTING Keep the victim lying down. Loosen tight clothing. If victim vomits, roll him onto his side or turn his head to the side. If necessary wipe out his mouth. Maintain an open airway. Bathe his face gently with cool water. Unless recovery is prompt, seek medical attention.

FRACTURES Deformity of an injured part usually means a fracture. If fracture is suspected, splint the part. DO NOT ATTEMPT TO MOVE INJURED PERSON. Seek medical attention immediately.

FROSTBITE Symptoms - Just before frostbite occurs skin may be flushed, then change to white or grayish-yellow. Pain may be felt early then subsides. Blisters may appear, affected part feels very cold and numb.

Treatment - Bring victim indoors, cover the frozen area, provide extra clothing and blankets. Rewarm frozen area quickly by immersion in warm water---NOT HOT WATER. DO NOT RUB THE PART. Seek medical attention immediately.

HEAT EXHAUSTION Caused by exposure to heat - either sun or indoors. Symptoms - Near normal body temperature. Skin is pale and clammy. Profuse sweating, tiredness, weakness, headache, perhaps cramps, nausea, dizziness, and possible fainting.

Treatment - Keep in lying position and raise victim's feet. Loosen clothing, apply cool wet cloths. If conscious, give sips of salt water (1 teaspoon of salt per glass) over a period of one hour. If vomiting occurs, discontinue the salt water. Seek medical attention immediately.

SUNSTROKE Symptoms - Body temperature is high (106 degrees F or higher). Skin is hot, red, and dry. Pulse is rapid and strong. Victim may be unconscious.

Treatment - Keep victim in lying position with head elevated. Remove clothing and repeatedly sponge the bare skin with cool water or rubbing alcohol. Seek medical attention immediately.

POISONING Call the poison control center for instruction on immediate care. If victim becomes unconscious, keep the airway open. If breathing stops give artificial respiration, by mouth to mouth breathing. Call an emergency squad as soon as possible.

POISON IVY Remove contaminated clothing; wash all exposed areas thoroughly with soap and water followed by rubbing alcohol. If rash is mild, apply calamine or other soothing skin lotion. If a severe reaction occurs, seek medical attention.

PUNCTURE WOUNDS If puncture wound is deeper than skin surface, seek medical attention. Serious infection can arise unless proper treatment is received.

SPRAINS Elevate injured part and apply ice bag or cold packs. DO NOT SOAK IN HOT WATER. If pain and swelling persist, seek medical attention.

UNCONSCIOUSNESS Never attempt to give anything by mouth. Keep victim lying flat, maintain open airway. If victim is not breathing provide artificial respiration by mouth to mouth breathing and call an emergency squad as soon as possible.

APPENDIX A
EMERGENCY PHYSICIAN ACCESS PLAN
NUS CORPORATION

A. MONDAY THROUGH FRIDAY, 9:00 A.M. - 5:00 P.M.

Dial the (412) 648-3240 number. When answered state that:

(1) you are calling from NUS Corporation;
(2) this is an emergency call.

Program staff will be alerted how to contact the physician designated to provide emergency coverage on that day. Collect calls will be accepted.

B. EVENINGS, WEEK-ENDS & HOLIDAYS:

Dial the (412) 648-3240 number. An operator from the answering service will answer the telephone. Do the following.

(1) tell the operator that you are calling from NUS Corporation
(2) tell the operator that this is an emergency call.
(3) give her your name
(4) give her the telephone number where the physician is to call. Be certain that she has written the correct number (area code and seven digits)
(5) if you do not receive a call back within 15 minutes place a second call to (412) 648-3240

Collect calls will be accepted.

C. SITUATIONS WHERE EMPLOYEE REQUIRES IMMEDIATE TRANSPORT TO A HOSPITAL:

If the situation is life-threatening, i.e., cardiac arrest or person not breathing, call the emergency medical services system and transport the person to the nearest hospital with advanced life support capabilities.

After obtaining assistance as stated above, call the (412) 648-3240 number and follow the procedures in A or B as appropriate.

Emergency Information: VD Site

Type	Name	Phone Nos.
Police	Sherrif	911 or 303-247
Ambulance		911
Hospital	Mercy	303-247-4311
Rescue Service/FIRE		911
Poison Control Center		1-800-228-951
CHSS	M.M. Soltis	412-788-1080
Site Manager	H. Roffman	412-788-1080
HSM	G. Smith 412-695-3667 HOME5	412-788-1080

Hospital Route (Attach Map)

- Left out of Landfill onto 160 west
- At first light 160 west dead ends into camino
- Go Left onto Camino
- Go to 14th and main st. split
- Go left at split
- Go to 17th st and make a right onto 17th
- Hospital is [illegible] at 17th and main.

Mercy Hospital
375 E. Park Ave

Inclement Weather Procedures

Field Decision

Emergency Information: S M

Type	Name	Phone Nos.
Police	Eugene P.D.	911 or 503-687-5
Ambulance		911
Hospital	Sacred Hart	503-686-7300
Rescue Service/FIRE		911
Poison Control Center		1-800-452-7165
CHSS	M.M. Soltis	412-788-1080
Site Manager	H. Roffman	412-788-1080
HSM	G. Smith 412-695-3667 HOME ↑	412-788-1080

Hospital Route (Attach Map)

- Go North on I5
- Exit at Eugene
- Merge onto Franklin
- Make a left onto Patterson
- Go two blocks
- Turn left on 13th
- You'll run into Hilyard and see the Hospital

Sacred Hart Hospital
1255 Hilyard

Inclement Weather Procedures

Field Decision

Emergency Information: **PG**

Type	Name	Phone Nos.
Police	Stevens Point	911 or 715-346-
Ambulance		911
Hospital	St. Michaels	715-346-5000
Rescue Service/FIRE		911
Poison Control Center		1-800-831-1111
CHSS	M.M. Soltis	412-788-1080
Site Manager	Haia Roffman	412-788-1080
HSM	G. Smith 412-695-3667 Home ↑	412-788-1080

Hospital Route (Attach Map)

- Take Hwy 10 west into Stevens Point
- Go through two sets of stop lights
- One block after stop lights is Illinois Ave.
- Hospital is within sight.

Inclement Weather Procedures

Field Decision

Site Background/Overall Information:

Each of the three sites accepted only municipal and/or solid commercial wastes to include garbage construction debris, demolition waste, sewage sludge and/or other non-hazardous materials. The SM landfill was thought to have temporarily stored PCB capacitors at the site. This should not pose a hazard to the field team.

Chemical Data/Toxicology Information/Other Pertinent Hazard Data:

Hazardous waste is not anticipated

Hazard Assessment:

A low hazard rating has been assigned to this task based on the fact that hazardous waste should not be encountered. The primary concern is the method of leachate sampling. Sampling from manholes is possible at two of the sites. Noone shall enter a manhole. Bailers and buckets can be used.

Standard Operating Procedures (i.e., basic hygiene, buddy system, no oral contact with any articles when working on site, etc.)

Other
- NO confined space entry -- ABSOLUTELY NON
- Treat all samples as hazardous
- Allow manholes to vent before working over top of them
- Avoid hand contact w/ ash - may contain glass & metal.
- Follow any h&s rule outlined by the respective landfills

PPE Requirements

→ Minimum - Steel toe/shank shoes or boots, standard field clothes, (If hard hats and safety glasses not worn indicate why).

Other Tyvek (coated)
Nitrile Gloves
Bull-dog boot covers / steel toe / shanks
Safety Glasses.
TLD - As per Co. policy
Hardhats if facility requires and/or overhead equipment is present

PPE Selection Criteria

To keep street clothes clean.

PPE Decon/Disposal (if applicable):

Leave on site

Monitoring Equipment and Calibration Information

LEL/O_2 meter - MSA 241 or MSA 260 - (with extension)
Calibrated in-house by Tom Patton · NUS Equipment Manager

Monitoring Equipment Selection Criteria:

Hazardous waste not anticipated but LEL/O_2 required to detect any explosion potential (i.e. methane buildup) concerns.

Monitor manholes etc. where sampling is to take place. Do this before, during activity.

Action Levels for Upgrading of PPE and/or Site Withdrawal:

LEL/O_2 Action levels

10% LEL - Proceed w/ caution; use spark proof tools/equipm
20% LEL - Withdraw immediately; Contact Pitt H&S

O_2 problems not anticipated FYI.

< 19.5% O_2 - SCBA required. Won't occur. No confined space entry.
≥ 25% O_2 - Oxygen rich atmosphere - possible explosion potential. Withdraw immediately. Contact Pitt H&S.

Note:

Incident Report, Site Safety Follow-Up Report, (None Site Maps available) will be attached.

APPENDIX F

S^3 - ANALYTICAL RESULTS REPORT FOR COLLECTED LEACHATES INCLUDING QA/QC DATA

S-CUBED

A Division of Maxwell Laboratories, Inc.

ANALYTICAL DATA REPORT - APPENDIX IX ANALYSES

Task 02 (Prime EPA Contract No. 68-01-7310)
Revised Final Report

S-CUBED Reference No. 31089-02
S-CUBED Document No. SSS-R-87-8629

Prepared for:

NUS Corporation
Park West Two
Cliff Mine Road
Pittsburg, PA 15275

Approved by:

Gregory R. Swanson
Subcontract Technical Manager

April 20, 1987

P. O. Box 1620, La Jolla, California 92038-1620
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1.0 INTRODUCTION

Twenty-two samples were submitted by NUS to S-CUBED for analysis. Of these, 20 were aqueous samples for Appendix IX parameters and two were soil/solid samples for analysis of chlorinated dibenzodioxins/dibenzofurans only. The samples were received in four shipments and were identified as follows:

Date Received	S-CUBED Control No.	NUS Identification
2/03/87	185-1	PC-LE-001
	185-2	PC-LE-002
	185-3	PC-LE-003
	185-3(DUP)	PC-LE-003A (DUP)
	185-4	NY-LE-01
	185-5	NY-LE-02
	185-6	NY-LE-03
	185-7	NY-ASH-01*
2/05/87	188-1	FL-LE-01
	188-2	FL-LE-02
	188-3	FL-LE-03
	188-4	SM-LE-001
	188-5	SM-LE-002
	188-6	SM-LE-003
2/06/87	191-1	VD-LE-000
	191-2	VD-LE-001
	191-3	VD-LE-002
	191-4	VD-LE-003
2/10/87	194-1	NC-LE-01
	194-2	NC-LE-02
	194-3	NC-LE-03
	194-4	NC-LE-01A (MS)
	194-5	NC-ASH-01*

*denotes soil/solid sample

Samples for dioxin analysis were sent to Battelle-Columbus Laboratories.

Standard S-CUBED laboratory chain-of-custody procedures were followed, beginning at the time of sample receipt. While awaiting analysis, all samples were stored in a walk-in refrigerator at 4° C.

2.0 ANALYTICAL METHODS

The standard analytical procedures followed for the analysis for the analysis of the samples were primarily SW-846[1] method as listed in Table 2.1. The exceptions are water methods[2] for the determination of fluoride (Method 340.1) and analysis of pesticides/PCBs and herbicides using proposed Method 1618 (soon be published in the Federal Register). Method 1618 is known as the *Consolidated GC Method for Determination of ITD/RCRA Pesticides Using Selected Detectors,* and is a consolidation of Methods 608, 614, 615, 617, 622, and 702.

A comprehensive list of analytes associated with these analytical procedures is given in Table 2.2.

****

1./ "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)," 3rd Edition, U.S. Environmental Protection Agency, 1986.

2./ Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020, Revised March 1983).

TABLE 2.1. Standard Analytical Procedures

SAMPLE PREPARATION

Analyte	Method	Reference Method (SW-846, 3rd Edition)
Metals Flame AAS or ICP Analyses	Acid Digestion of Aqueous Liquids	3005
Metals Flame AAS or ICP Analyses	Acid Digestion of Aqueous Liquids	3010
Metals Furnace AAS Analyses	Acid Digestion of Aqueous Liquids	3020
Volatile Organic Compounds	Purge and Trap	5030
Semivolatile Organic Compounds	Continuous Liquid-Liquid Extraction	3520
Organochlorine Pesticides and PCBs	Continuous Liquid-Liquid Extraction	W-1618
Organophosphorus Pesticides	Continuous Liquid-Liquid Extraction	W-1618
Chlorinated Herbicides by Derivitization	Continuous Liquid-Liquid Extraction	W-1618

TABLE 2.1. Standard Analytical Procedures (Continued)

INORGANIC ANALYSES

Analyte	Method	Reference Method
Aluminum	Flame	7020
Antimony	Furnace	7041
Arsenic	Furnace	7060
Barium	Flame	7080
Beryllium	Flame	7090
Cadmium	Furnace	7131
Calcium	Flame	7140
Chromium	Furnace	7191
Cobalt	Flame	7200
Copper	Flame	7210
Iron	Flame	7380
Lead	Furnace	7421
Magnesium	Flame	7450
Manganese	Flame	7460
Mercury	Cold Vapor AAS	7470
Nickel	Flame	7520
Osmium	Flame	7550
Potassium	Flame	7610
Selenium	Furnace	7740
Silver	Flame	7760
Sodium	Flame	7770
Thallium	Furnace	7841
Tin	Flame	7870
Vanadium	Furnace	7911
Zinc	Flame	7950
Cyanide	Colorimetric	9010
Fluoride	Colorimetric	W-340.1
Sulfide	Titrimetric	9030

ORGANIC ANALYSES

Analyte	Method	Reference Method
Volatile Organic Compounds	Packed Column GC/MS	8240
Semivolatile Organic Compounds (Base/Neutral and Acid Extractables)	Capillary Column GC/MS	8270
Organochlorine Pesticides and PCBs	GC/ECD	W-1618
Organophosphorus Pesticides	GC/FPD	W-1618
Chlorinated Herbicides	GC/ECD	W-1618

TABLE 2.2. Analyte List

VOLATILE ORGANICS BY GC/MS (Method 8240)

Chlorinated Methanes
- Carbon Tetrachloride
- Chloroform (Trichloromethane)
- Chloromethane
- Methylene Chloride (Dichloromethane)

Chlorinated Ethanes
- Chloroethane
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- 1,1-Dichloroethylene
- trans-1,2-Dichloroethylene
- 1,1,1,2-Tetrachloroethane
- 1,1,2,2-Tetrachloroethane
- Tetrachloroethylene
- 1,1,2-Trichloroethane
- Trichloroethylene
- Vinyl Chloride (Chloroethylene

Chlorinated Propanes/Butanes
- Allyl Chloride (3-Chloropropylene)
- 1,2-Dichloropropane
- cis-1,3-Dichloropropylene
- trans-1,3-Dichloropropylene
- 1,2,3-Trichloropropane
- trans-1,4-Dichloro-2-butene

Chloroalkyl Ethers
- 2-Chloroethyl vinyl ether

Chlorinated Bromocarbons
- Bromodichloromethane
- Dibromochloromethane

Bromocarbons
- Bromoform (Tribromomethane)
- Bromomethane
- 1,2-Dibromomethane (EDB)
- Dibromomethane

Chlorinated Fluorocarbons
- Dichlorodifluoromethane
- Trichlorofluoromethane
- 1,1,2-Trichlor-1,2,2-trifluoroethane

Acid Esters
- Ethyl methacrylate
- Methyl methacrylate
- Vinyl acetate

Aromatic Hydrocarbons
- Benzene
- Ethyl benzene
- Styrene
- Toluene
- Xylenes

Ketones and Aldehydes
- Acetone
- Acrolein (2-Propenal)
- 2-Hexanone
- Methyl ethyl ketone (2-Butanone)
- Methyl isobutyl ketone (4-Methyl-2-pentanone)

Nitriles
- Acrylonitrile
- Methacrylonitrile

Miscellaneous
- Acetonitrile**
- Carbon disulfide
- 1,4-Dioxane*
- Iodomethane
- Pyridine*

* Poor response factor. Other methods may yield improved quantitative analysis.

** Signifies specific analytical problems (e.g. standard availability).

TABLE 2.2. Analyte List (Continued)

SEMIVOLATILE ORGANICS BY GC/MS (Method 8270)

Chlorinated Ethanes/Propanes
- Hexachloroethane
- Hexachloropropene
- Pentachloroethane

Chlorinated Butanes/Pentanes
- Hexachlorobutadiene
- Hexachlorocyclopentadiene

Chlorinated Benzenes/Naphthalenes
- 2-Chloronaphthalene
- o-Dichlorobenzene (1,2-Dichlorobenzene)
- m-Dichlorobenzene (1,3-Dichlorobenzene)
- p-Dichlorobenzene (1,4-Dichlorobenzene)
- Hexachlorobenzene
- Pentachlorobenzene
- 1,2,4,5-Tetrachlorobenzene
- 1,2,3-Trichlorobenzene*
- 1,2,4-Trichlorobenzene

Chlorinated Phenols
- p-Chloro-m-cresol (4-Chloro-3-methylphenol)
- 2-Chlorophenol
- 2,4-Dichlorophenol
- 2,6-Dichlorophenol
- Pentachlorophenol
- 2,3,4,6-Tetrachlorophenol
- 2,4,6-Trichlorophenol
- 2,4,5-Trichlorophenol

Chlorinated Aromatic Amines
- p-Chloroaniline (4-Chloroaniline)
- 3,3'-Dichlorobenzidine
- 4,4'-Methylene bis(2-chloroaniline)

Haloethers
- Bis(2-chloroethoxy) methane
- Bis(2-chloroethyl) ether
- Bis(2-Chloroisopropyl) ether
- 4-Bromophenyl phenyl ether
- 4-Chlorophenyl phenyl ether

Alcohols and Ethers
- Benzyl alcohol
- Resorcinol

Ketones
- Acetophenone
- p-Benzoquinone (1,4-Benzoquinone)
- Isophorone
- 1,4-Naphthoquinone

Naphthalenes/Biphenyls
- 2-Methylnaphthalene
- Naphthalene

Phenols
- 2,4-Dimethylphenol
- o-Cresol (2-Methylphenol)
- p-Cresol (4-Methylphenol)
- Phenol

Phthalate Esters
- Bis(2-ethylhexyl) phthalate
- Butyl benzyl phthalate
- Diethyl phthalate
- Dimethyl phthalate
- Di-n-butyl phthalate
- Di-n-octyl phthalate

Polynuclear Aromatic Hydrocarbons
- Acenaphthene
- Acenaphthylene
- Anthracene
- Benz(a)anthracene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(a)pyrene
- Chrysene
- Dibenzo(a,h)anthracene
- Dibenzo(a,e)pyrene
- Dibenzo(a,i)pyrene
- 7,12-Dimethylbenz(a)anthracene
- Fluorene
- Fluoranthene
- Indeno(1,2,3-cd)pyrene
- 3-Methylcholanthrene
- Phenanthrene
- Pyrene

*Not on the proposed 40 CFR 264, Appendix IX list (51 FR 26632).

TABLE 2.2. Analyte List (Continued)

SEMIVOLATILE ORGANICS BY GC/MS (Method 8270) - Continued

Aromatic Amines
2-Acetylaminofluorene
4-Aminobiphenyl
Aniline
Benzidine
Carbazole
p-Dimethylaminoazobenzene
3,3'-Dimethylbenzidine
a,a-Dimethylphenethylamine
Diphenylamine
1-Naphthylamine
2-Naphthylamine
Phenylenediamine

Nitrated Aromatic Amines
2-Nitroaniline
3-Nitroanaline
4-Nitroaniline
5-Nitro-o-toluidine (5-nitro-2-amino toluene)

Nitroaromatics
m-Dinitrobenzine (1,3-Dinitrobenzene)
2,4-Dinitrotoluene
2,6-Dinitritoluene
Nitrobenzene

Nitrophenols
4,6-Dinitro-o-cresol (4,6-Dinitro-2-methyl phenol)(DNOC)
2,4-Dinitrophenol
2-Nitrophenol
4-Nitrophenol

Nitrosamines
N-Nitroso-di-n-butylamine
N-Nitrosodiethylamine
N-Nitrosodimethylamine
N-Nitrosophenylamine*
N-Nitroso-di-n-propylamine**
N-Nitrosomethylethylamine
N-Nitrosomorpholine
N-Nitrosopiperidine
N-Nitrosopyrrolidine

Sulfur-Containing Hydrocarbons
Benzenethiol

Miscellaneous
Aramite*
Benzoic Acid
3-Chloropropionitrile
m-Cresol (3-Methylphenol)
Dibenzofuran
1,2-Dibromo-3-chloropropane (DBCP)
3,3'-Dimethoxybenzidine
1,2-Diphenylhydrazine
Hexachlorophene
Malononitrile (Propanedinitrile)
Methapyrilene
Methyl methane sulfonate*
Phenacetin (Acetophenetidin)
2-Picoline
Pronamide
Safrole
Trichloromethanethiol
Tris(2,3-dibromopropyl)phosphate*

* Signifies potential analytical difficulties.
** Not on proposed 40 CFR 264, Appendix IX list (51 FR 26632).

TABLE 2.2. Analyte List (Continued)

ORGANOCHLORINE PESTICIDES AND PCBS BY GC/ECD (Method 8080)

Diene-Based
- Aldrin
- Dieldrin
- Endrin
- Endrin Aldehyde*
- Heptachlor
- Hepthachlor Epoxide
- Isodrin

BHCs
- α-BHC
- β-BHC
- γ-BHC
- ℓ-BHC (Lindane)

DDT and Derivatives
- 4,4'-DDD
- 4,4'-DDE
- 4,4'-DDT

Endosulfans
- Endosulfan I
- Endosulfan II

Other Pesticides
- Chlordane
- Chlorobenzilate*
- Kepone
- Methoxychlor
- Pentachloronitrobenzene (PCNB)*
- Toxaphene

PCBs
- Aroclor 1016
- Aroclor 1221
- Aroclor 1232
- Aroclor 1242
- Aroclor 1248
- Aroclor 1254
- Aroclor 1260

*Denotes potential analytical difficulties.

TABLE 2.2. Analyte List (Continued)

ORGANOPHOSPHORUS PESTICIDES BY GC/FPD (Method 8140)

Disulfoton +
Famphur + #
Parathion, ethyl +
Parathion, methyl +
Phorate +
Sulfotepp +
Zinophos + * #

+ On the proposed CRF, Appendix IX list (51 FR 26632).
*Denotes potential analytical difficulties (e.g., standard availability).
#Not currently approved analyte for Method 8140

CHLORINATED HERBICIDES BY DERIVITIZATION AND GC/ECD (Method 8150)

Category/Common Name	Systematic Name
2,4-D and Derivatives	
2,4-D	2,4-Dichlorophenoxyacetic Acid*
2,4,5-T and Derivatives	
2,4,5-T	2,4,5-Trichlorophenoxyacetic Acid*
2,4,5-TP (Silvex	2,4,5-Trichlorophenoxypropionic Acid*
Dinitrophenol Derivatives	
Dinoseb	2-sec-Butyl-4,6-dinitrophenol (DNBP)*

*Currently listed on 40 CFR 261, Appendix VIII.
#Not on the proposed 40 CFR 264, Appendix IX list (51 FR 26632).

TABLE 2.2. Analyte List (Continued)

Inorganic Analytes

- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Nickel
- Osmium
- Potassium
- Selenium
- Silver
- Sodium
- Thallium
- Tin
- Vanadium
- Zinc
- Cyanide
- Fluoride
- Sulfide

Dioxin (Included with Method 8270)

- 2,3,7,8-Tetrachlorodibenzo-p-dioxin

3.0 ANALYTICAL RESULTS

The analytical results for the water samples can be found in Tables 3.1 through 3.3. These tables list the concentration of all analytes detected. Values reported with a flag of *J* represent compounds identified, but with values calculated to be below the formal detection limit. Values reported with a flag of B represent analytes found in the blank as well as the sample and warn of possible/probable contamination. Analytes not detected or otherwise qualified are not reported in these tables. Additional information pertaining to these samples, including S-CUBED standard reporting sheets and detection limits can be found in Appendices A through C.

TABLE 3.1. GC Data Summary - All Compounds Detected

S-CUBED ID	NUS ID	2,4-D	Gamma-BHC (Lindane)	Endrin	Endosulfan Sulfate	4,4'-DDT
185-1	PC-LE-001	ND	ND	ND	0.28	0.042 J
185-2	PC-LE-002	ND	ND	ND	ND	0.05 J
185-3	PC-LE-003	ND	0.017 J	ND	ND	0.10
185-4	NY-LE-01	130	ND	0.25	ND	0.053 J
185-5	NY-LE-02	ND	ND	ND	ND	0.098 J
185-6	NY-LE-03	160	ND	ND	ND	0.099 J
188-1	FL-LE-01	ND	ND	ND	ND	0.14
188-2	FL-LE-02	ND	ND	ND	ND	0.16
188-3	FL-LE-03	ND	ND	ND	ND	0.22
188-4	SM-LE-001	120	ND	ND	ND	0.11
188-5	SM-LE-002	89	ND	ND	ND	0.056 J
188-6	SM-LE-003	ND	ND	ND	ND	0.042 J
191-1	VD-LE-000	ND	ND	ND	ND	ND
191-2	VD-LE-001	ND	ND	ND	ND	ND
191-3	VD-LE-002	ND	ND	ND	ND	ND
191-4	VD-LE-003	ND	ND	ND	ND	ND
194-1	NC-LE-01	ND	ND	ND	ND	0.12
194-2	NC-LE-02	ND	ND	ND	ND	0.12
194-3	NC-LE-03	ND	ND	ND	ND	0.13

Concentrations reported are in Ug/L and are confirmed by GC Dual Column.

J Indicates as estimated value. This flag is used when the data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero (e.g. 10 J). If the detection limit is 10 Ug/L and a concentration of 3 Ug/L is calculated, the value is reported as 3 J.

TABLE 3.2. GC/MS Data Summary - Volatile Compounds Detected

S-CUBED ID	NUS ID	Acetone	2-Butanone	1,1-Dichloro-ethane	Trans-1,2-Dichloroethane	Ethyl-Benzene	2-Hexanone	Methylene Chloride
185-1	PC-LE-001	4	9.9	ND	ND	ND	0.69	0.31
185-2	PC-LE-002	4.1	11	ND	ND	ND	0.41 J	0.32
185-3	PC-LE-003	4.3	12	ND	ND	ND	0.36	0.092
185-4	NY-LE-01	0.81	2.2	ND	ND	ND	ND	0.098
185-5	NY-LE-02	0.15	1.6	ND	ND	ND	ND	0.17
185-6	NY-LE-03	ND	ND	ND	ND	ND	ND	0.19
188-1	FL-LE-01	4.6	1.5	ND	ND	ND	0.4	0.006 J
188-2	FL-LE-02	3.8	1.3	ND	ND	ND	0.039 J	0.11
188-3	FL-LE-03	1.9	3	ND	ND	ND	0.085 J	0.04 J
188-4	SM-LE-001	0.17	0.29	ND	ND	ND	0.006 J	0.002 J
188-5	SM-LE-002	0.35	0.43	ND	ND	ND	ND	0.003 J
188-6	SM-LE-003	0.29	0.44	ND	ND	ND	0.012	0.003 J
191-1	VD-LE-000	ND	ND	ND	ND	ND	ND	0.007
191-2	VD-LE-001	ND	ND	0.004 J	0.016	ND	ND	0.012
191-3	VD-LE-002	0.008 J	ND	ND	0.006	ND	ND	0.014
191-4	VD-LE-003	0.004 J	ND	ND	0.012	ND	ND	0.006
194-1	NC-LE-01	0.18	0.12	ND	ND	ND	ND	0.29
194-2	NC-LE-02	0.43	0.73	ND	ND	0.015 J	0.088	0.039
194-3	NC-LE-03	1.5	1.1	ND	ND	ND	0.45	0.038

S-CUBED ID	NUS ID	Toluene	1,1,3-Tri-Chloropropane	Total Xylenes	4-Methyl-2-Pentanone
185-1	PC-LE-001	0.54	0.23 J	ND	0.57
185-2	PC-LE-002	0.55	ND	ND	ND
185-3	PC-LE-003	0.61	ND	ND	0.061
185-4	NY-LE-01	0.12	ND	ND	ND
185-5	NY-LE-02	0.12	ND	ND	ND
185-6	NY-LE-03	ND	ND	ND	ND
188-1	FL-LE-01	1	ND	ND	0.29
188-2	FL-LE-02	1.1	ND	ND	ND
188-3	FL-LE-03	ND	ND	ND	ND
188-4	SM-LE-001	ND	ND	ND	ND
188-5	SM-LE-002	ND	ND	ND	ND
188-6	SM-LE-003	ND	ND	ND	ND
191-1	VD-LE-000	ND	ND	ND	ND
191-2	VD-LE-001	ND	ND	ND	ND
191-3	VD-LE-002	ND	ND	ND	ND
191-4	VD-LE-003	ND	ND	ND	ND
194-1	NC-LE-01	0.094	ND	ND	ND
194-2	NC-LE-02	0.073	ND	0.29	ND

TABLE 3.3. GC/MS Data Summary - Semivolatile Compounds Detected

S-CUBED ID	NUS ID	p-Cresol	Phenol	Bis(2-Ethyl-Hexyl)Phthalate	Diethyl-Phthlate
185-1	PC-LE-001	4.4	1.4	ND	ND
185-2	PC-LE-002	4.4	1.7	ND	ND
185-3	PC-LE-003	4.5	1.8	ND	ND
185-4	NY-LE-01	5.1	2.1	ND	ND
185-5	NY-LE-02	ND	ND	ND	ND
185-6	NY-LE-03	ND	ND	0.17	ND
188-1	FL-LE-01	ND	ND	0.017 B	0.032
188-2	FL-LE-02	ND	ND	0.019 B	ND
188-3	FL-LE-03	ND	ND	ND	ND
188-4	SM-LE-001	0.054	0.041	ND	ND
188-5	SM-LE-002	0.053	0.045	ND	ND
188-6	SM-LE-003	0.078	0.078	ND	ND
191-1	VD-LE-000	ND	ND	ND	ND
191-2	VD-LE-001	ND	ND	ND	ND
191-3	VD-LE-002	ND	ND	ND	ND
191-4	VD-LE-003	ND	ND	ND	ND
194-1	NC-LE-01	0.21	0.089	ND	ND
194-2	NC-LE-02	ND	0.098	ND	ND
194-3	NC-LE-03	ND	0.078	ND	ND

All concentrations are in Mg/L

B Indicates that the analyte was found in the blank as well as the sample.

TABLE 3.4. Analytical Data Summary - Metal Analysis (All results are expressed in mg/L)

S-CUBED ID	NUS ID	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese
186-1	PC-LE-001	2.4	ND	0.011	1.64	ND	0.003	0.011	ND	ND	268	ND	8.28
186-2	PC-LE-002	3.4	ND	0.008	1.70	ND	0.003	0.039	ND	ND	261	0.048	8.87
186-3	PC-LE-003	2.8	ND	0.008	1.57	ND	ND	0.006	ND	ND	242	0.012	8.28
186-3D	PC-LE-003A	2.2	ND	0.014	1.43	ND	ND	0.065	ND	ND	214	ND	7.59
186-4	NY-LE-01	ND	0.02	0.010	0.89	ND	0.011	0.009	ND	0.18	93.8	0.018	11.3
186-5	NY-LE-02	ND	0.01	0.008	0.89	ND	0.009	0.011	ND	0.20	92.4	0.010	11.2
186-6	NY-LE-03	ND	0.02	0.012	0.82	ND	0.006	0.013	ND	0.19	93.8	0.022	11.3
188-1	FL-LE-01	5.4	ND	0.023	0.48	ND	0.006	0.012	ND	ND	16.3	0.053	1.31
188-2	FL-LE-02	5.8	ND	0.019	0.48	ND	0.005	0.012	ND	ND	17.6	0.035	1.34
188-3	FL-LE-03	5.0	ND	0.023	0.34	ND	0.007	0.010	ND	ND	16.4	0.061	1.30
188-4	SM-LE-001	ND	ND	0.010	0.41	ND	0.002	0.006	ND	ND	6.4	0.009	1.68
188-5	SM-LE-002	ND	ND	0.009	0.34	ND	0.003	0.005	ND	ND	6.5	0.015	1.67
188-6	SM-LE-003	1.6	ND	0.009	0.34	ND	0.002	0.009	ND	ND	6.6	0.006	1.68
191-1	VD-LE-000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
191-2	VD-LE-001	ND	ND	0.007	0.48	ND	ND	0.003	ND	ND	23.2	ND	0.30
191-3	VD-LE-002	ND	ND	0.006	0.55	ND	ND	0.002	ND	ND	21.2	ND	0.27
191-4	VD-LE-003	ND	ND	0.007	0.48	ND	ND	0.003	ND	ND	22.8	ND	0.31
194-1	NC-LE-01	ND	ND	0.044	0.27	ND	ND	ND	ND	ND	21.1	0.026	1.31
194-2	NC-LE-02	ND	ND	0.046	0.41	ND	ND	0.005	ND	ND	104	0.027	1.48
194-3	NC-LE-03	ND	ND	0.044	0.34	ND	ND	0.008	ND	ND	20.9	0.018	1.29
Method Detection Limit		1.5	0.01	0.003	0.10	0.04	0.002	0.003	0.16	0.05	1.2	0.007	0.08

S-CUBED ID	NUS ID	Mercury	Nickel	Osmium	Potassium	Selenium	Silver	Sodium	Thallium	Tin	Vanadium	Zinc	Calcium	Magnesium
186-1	PC-LE-001	ND	ND	ND	453.7	ND	ND	817.0	ND	ND	0.016	0.44	709	424
186-2	PC-LE-002	ND	0.13	ND	471.8	ND	ND	822.8	ND	ND	0.019	0.51	657	422
186-3	PC-LE-003	ND	0.13	ND	471.8	ND	ND	846.3	ND	ND	0.018	0.38	794	412
186-3D	PC-LE-003A	ND	ND	ND	363.0	ND	ND	752.3	ND	ND	0.024	0.33	747	400
186-4	NY-LE-01	ND	0.23	ND	580.7	ND	ND	1645.7	ND	ND	0.015	1.21	775	199
186-5	NY-LE-02	ND	0.23	ND	707.8	ND	ND	1669.2	ND	ND	0.015	1.21	765	184
186-6	NY-LE-03	ND	0.24	ND	780.3	ND	ND	2280.4	ND	ND	ND	1.21	803	191
188-1	FL-LE-01	ND	ND	ND	871.1	0.006	ND	1293.0	ND	ND	0.009	2.32	352	125
188-2	FL-LE-02	ND	ND	ND	744.0	0.006	ND	1228.4	ND	ND	0.011	2.59	343	117
188-3	FL-LE-03	ND	ND	ND	816.6	ND	ND	1610.5	ND	ND	0.021	2.39	319	116
188-4	SM-LE-001	ND	0.13	ND	217.8	ND	ND	576.0	ND	ND	0.023	0.24	150	75
188-5	SM-LE-002	ND	0.13	ND	228.7	ND	ND	781.7	ND	ND	0.024	0.30	174	74
188-6	SM-LE-003	ND	0.13	ND	199.6	ND	ND	1334.2	ND	ND	0.020	0.28	146	77
191-1	VD-LE-000	ND	ND	ND	ND	ND	ND	118.0	ND	ND	ND	0.08	ND	ND
191-2	VD-LE-001	ND	ND	ND	145.2	ND	ND	552.5	ND	ND	0.013	0.07	272	189
191-3	VD-LE-002	ND	0.14	ND	270.4	ND	ND	552.5	ND	ND	0.011	0.18	263	182
191-4	VD-LE-003	ND	0.16	ND	268.6	ND	ND	681.8	ND	ND	0.014	0.10	258	189
194-1	NC-LE-01	ND	0.13	ND	613.4	ND	ND	1075.6	ND	ND	0.017	0.15	216	118
194-2	NC-LE-02	ND	0.14	ND	526.3	ND	ND	1487.0	ND	ND	0.029	0.09	207	124
194-3	NC-LE-03	ND	ND	ND	508.1	ND	ND	1134.3	ND	ND	0.024	0.12	174	114
Method Detection Limit		0.002	0.13	45	0.20	0.006	0.05	0.04	0.8	2.1	0.009	0.01	69	80

4.0 QA/QC SAMPLE RESULTS

Quality assurance objectives for precision and accuracy are expressed in terms of relative percent deviation (RPD) for duplicate analysis and percent recovery of matrix spike compounds. Two samples received were specifically labelled for duplicate and matrix spike/matrix spike duplicate analyses (PC-LE-003A and NC-LE-01A respectively). Tables 4.1 through 4.7 detail the accuracy and/or precision associated in the analysis of these samples. Percent recovery of surrogate compounds added to each sample can be found in Table 4.7.

Note that for cyanide analysis, S-CUBED Number 185-3 (PC-LE-003) was used for matrix spike analysis because of matrix interference problems encountered with 194-4 MS (NC-LE-01A).

TABLE 4.1. QC Results - GC Duplicate Analyses

Pesticides/PCB Analysis	188-3 (ug/l)	188-3 DUP (ug/l)	RPD
Alpha-BHC	ND	ND	-
Beta-BHC	ND	ND	-
Delta-BHC	ND	ND	-
Gamma-BHC(Lindane)	0.017 J	0.023 J	30
Heptachlor	ND	ND	-
Aldrin	ND	ND	-
Heptachlor Epoxide	ND	ND	-
Endosulfan I	ND	ND	-
Dieldrin	ND	ND	-
4,4'-DDE	ND	ND	-
Endrin	ND	ND	-
Endosulfan II	ND	ND	-
4,4'-DDD	ND	ND	-
Endrin Aldehyde	ND	ND	-
Endosulfan Sulfate	ND	ND	-
4,4'-DDT	0.10	0.11	9.52
Methoxychlor	ND	ND	-
Endrin ketone	ND	ND	-
Chlordane	ND	ND	-
Toxaphene	ND	ND	-
Arochlor-1016	ND	ND	-
Arochlor-1221	ND	ND	-
Arochlor-1232	ND	ND	-
Arochlor-1242	ND	ND	-
Arochlor-1248	ND	ND	-
Arochlor-1254	ND	ND	-
Arochlor-1260	ND	ND	-
Organophoshate Analysis			
Phorate	ND	ND	-
Sulfotepp	ND	ND	-
Disulfoton	ND	ND	-
Methyl Parathion	ND	ND	-
Ethyl Parathion	ND	ND	-
Famphur	ND	ND	-
Herbicide Analysis			
2,4-D	ND	ND	-
2,4,5-TP	ND	ND	-
2,4,5-T	ND	ND	-
Dinoseb	ND	ND	-

TABLE 4.2 QC Results - VOA Duplicate Analysis

	185-3 (mg/l)	185-3 Dup (mg/l)	RPD
Acetone	4.3	4	7.23
Benzene	ND	ND	-
Bromodichloromethane	ND	ND	-
Bromomethane	ND	ND	-
2-Butanone	12	10	18.18
Carbon Tetrachloride	ND	ND	-
Chlorobenzene	ND	ND	-
Dibromochloromethane	ND	ND	-
Chlorethane	ND	ND	-
2-Chlorethylvinylether	ND	ND	-
Chlorform	ND	ND	-
Chloromethane	ND	ND	-
1,1-Dichloroethane	ND	ND	-
1,2-Dichloroethane	ND	ND	-
1,1-Dichloroethene	ND	ND	-
Trans-1,2-Dichloroethene	ND	ND	-
1,2-Dichloropropane	ND	ND	-
1,2-Dibromomethane	ND	ND	-
Dibromomethane	ND	ND	-
Methyl Methacrylate	ND	ND	-
Acrolein	ND	ND	-
Acrylonitrile	ND	ND	-
Methacrylonitrile	ND	ND	-
1,4-Dioxane	ND	ND	-
Ethyl Cyanide	ND	ND	-
CIS-1,3-Dichlorpropene	ND	ND	-
Trans-1,3-Dichloropropene	ND	ND	-
Ethylbenzene	ND	ND	-
2-Hexanone	0.36	0.37	2.73
Methylene Chloride	0.092	0.36	118.58
Styrene	ND	ND	-
1,1,2,2-Tetrachloroethane	ND	ND	-
Tetrachloroethene	ND	ND	-
Toluene	0.61	0.59	3.33
1,1,1-Trichloroethane	ND	ND	-
1,1,2-Trichloroethane	ND	ND	-
Trichloroethene	ND	ND	-
1,2,3-Trichloropropane	ND	ND	-
Vinyl Chloride	ND	ND	-
Total Xylenes	ND	ND	-
Allyl Chloride	ND	ND	-
1,1,1,2-Tetrachloroethane	ND	ND	-
Trans-1,4-Dichloro-2-Butene	ND	ND	-
Iodomethane	ND	ND	-
Trichlorofluoromethane	ND	ND	-
1,1,2-Trichlorotrifluoroethane	ND	ND	-
Bromoform	ND	ND	-
Vinyl Acetate	ND	ND	-
4-Methyl-1-Pentanone	0.061	0.11	57.31
Carbon Disulfide	ND	ND	-

TABLE 4.3. QC Results - Semivolatile Duplicate Analysis

	185-3 (mg/l)	185-3D (mg/l)	RPD
2-Acetylaminofluorene	ND	ND	-
4-Aminobiphenyl	ND	ND	-
Aniline	ND	ND	-
Benzidine	ND	ND	-
Carbazole	ND	ND	-
p-Dimethylaminoazobenzene	ND	ND	-
3,3-Dimethylbenzidine	ND	ND	-
a,a-Dimethylphenethylamine	ND	ND	-
Diphenylamine	ND	ND	-
1-Naphthtlamine	ND	ND	-
2-Naphthylamine	ND	ND	-
Phenylenediamine	ND	ND	-
2-Nitroaniline	ND	ND	-
3-Nitroaniline	ND	ND	-
4-Nitroaniline	ND	ND	-
5-Nitro-O-Toluidine	ND	ND	-
m-Dinitrobenzene	ND	ND	-
2,4-Dinitrotoluene	ND	ND	-
2,6-Dinitrotoluene	ND	ND	-
Nitrobenzene	ND	ND	-
4,6-Dinitro-O-Cresol	ND	ND	-
2,4-Dinitrophenol	ND	ND	-
2-Nitrophenol	ND	ND	-
4-Nitrophenol	ND	ND	-
N-Nitroso-Di-N-Butylamine	ND	ND	-
N-Nitrosodiethylamine	ND	ND	-
N-Nitrosodimethylamine	ND	ND	-
N-Nitrosodiphenylamine	ND	ND	-
N-Nitrosomethylethylamine	ND	ND	-
N-Nitrosomorpholine	ND	ND	-
N-Nitrosoperidine	ND	ND	-
N-Nitrosopyrrolidine	ND	ND	-
m-Dichlorobenzene	ND	ND	-
p-Dichlorobenzene	ND	ND	-
Hexachlorobenzene	ND	ND	-
Pentachlorobenzene	ND	ND	-
1,2,4,5-Tetrachlorobenzene	ND	ND	-
1,2,4-Trichlorobenzene	ND	ND	-
p-Chloro-m-Cresol	ND	ND	-
2-Chlorophenol	ND	ND	-
2,4-Dichlorophenol	ND	ND	-
Pentachlorophenol	ND	ND	-
2,3,4,6-Tetrachlorophenol	ND	ND	-
2,4,6-Trichlorophenol	ND	ND	-
2,4,5-Trichlorophenol	ND	ND	-
p-Chloroaniline	ND	ND	-
3,3-Dichlorobenzidine	ND	ND	-
4,4-Methylene Bis(2-Chloroaniline)	ND	ND	-
Bis(2-Chloroethoxy)Methane	ND	ND	-
Bis(2-Chloroethyl)Ether	ND	ND	-
Bis(2-Chlorisopropyl)Ether	ND	ND	-
4-Bromophenyl Phenyl Ether	ND	ND	-
4-Chlorophenyl Phenyl Ether	ND	ND	-
Benzyl Alcohol	ND	ND	-
Resorcinol	ND	ND	-
Acetophenol	ND	ND	-
p-Benzoquinone	ND	ND	-
Isophorone	ND	ND	-
1,4-Naphthquinone	ND	ND	-
2-Methylnaphthalene	ND	ND	-
Naphthalene	ND	ND	-
2,4-Dimethylphenol	ND	ND	-
Benzenethiol	ND	ND	-
Aramite	ND	ND	-
Benzoic Acid	ND	ND	-
3-Chloropropionitrile	ND	ND	-
m-Cresol	ND	ND	-
Dibenzofuran	ND	ND	-
1,2-Dibromo-3-Chloropropane	ND	ND	-
3,3-Dimethoxybenzidine	ND	ND	-
1,2-Diphenylhydrazine	ND	ND	-
Hexachlorphene	ND	ND	-
Isosafrole	ND	ND	-
Malonitrile	ND	ND	-
Methapyriline	ND	ND	-
Methyl Methane Sulfonate	ND	ND	-
Phenacetine	ND	ND	-
2-Picoline	ND	ND	-
Pronamide	ND	ND	-
Safrole	ND	ND	-
Trichloromethanethiol	ND	ND	-
Tris(2,3-Dibromopropyl)Phospate	ND	ND	-
Pyridine	ND	ND	-
Ethyl Methacryalate	ND	ND	-
Hexachloroethane	ND	ND	-
Hexachloropropene	ND	ND	-
Pentachloroethane	ND	ND	-
Hexachlorobutadiene	ND	ND	-
Hexachlorocyclopentadiene	ND	ND	-
2-Chloronaphthalene	ND	ND	-

TABLE 4.3. QC Results - Semivolatile Duplicate Analysis (Continued)

	185-3 (mg/l)	185-3D (mg/l)	RPD
o-Cresol	ND	ND	-
p-Cresol	4.5	5.1	12.37
Phenol	1.8	2.1	15.38
Bis(2-Ethylhexyl)Phthalate	ND	ND	-
Butyl Benzyl Phthalate	ND	ND	-
Diethyl Phthalate	ND	ND	-
Dimethyl Phthalate	ND	ND	-
Di-N-Butyl Phthalate	ND	ND	-
Di-N-Octyl Phthalate	ND	ND	-
Acenaphthene	ND	ND	-
Acenaphthtlene	ND	ND	-
Anthracene	ND	ND	-
Benz(a)anthracene	ND	ND	-
Benzo(b)Fluoranthene	ND	ND	-
Benzo(k)Fluoranthene	ND	ND	-
Benzo(g,h,i)Perylene	ND	ND	-
Benzo(A)Pyrene	ND	ND	-
Chrysene	ND	ND	-
Dibenzo(a,h)Anthracene	ND	ND	-
Dibenzo(a,e)Pyrene	ND	ND	-
Dibenzo(a,l)Pyrene	ND	ND	-
7,12-Dimethylbenzo(A)Anthracene	ND	ND	-
Fluorene	ND	ND	-
Fluoranthene	ND	ND	-
Indeno(1,2,3-cd)Pyrene	ND	ND	-
3-Methylchloanthrene	ND	ND	-
Phenanthrene	ND	ND	-
Pyrene	ND	ND	-

TABLE 4.4. QC Results - Inorganics - Duplicate Analyses

Analyte	185-3	185-3D	RPD
Fluoride	1.09	1.04	4.74
Sulfide	2.86	3.2	11.22
Cyanide	0.04	0.04	0
Aluminum	2.79	2.19	24.0
Antimony	0.0045	0.0027	50.0
Arsenic	0.0077	0.0135	54.6
Barium	1.572	1.436	9.0
Beryllium	-0.015	-0.022	37.8
Calcium	793.5	746.6	6.1
Cadmium	0.000901	0.000793	12.8
Chromium	0.00598	0.00654	8.9
Cobalt	0	0.019	50.0
Copper	-0.010	-0.010	0
Iron	242.5	213.6	12.7
Lead	0.012	0.005	79.5
Magnesium	411.8	400.3	2.8
Manganese	8.276	7.594	8.6
Mercury	< DL	< DL	-
Nickel	0.128	0.114	11.6
Osmium	< DL	< DL	-
Potassium	471.8	363.0	26.1
Selenium	0.0005	0.0005	0
Silver	-0.0089	0.0	200
Sodium	846.3	752.3	11.8
Thallium	< DL	< DL	-
Tin	0	-0.644	200
Vanadium	0.0180	0.0243	29.8
Zinc	0.3764	0.3273	14.0

TABLE 4.5. QC Results Spike/Matrix Spike Duplicate Recovery - Organic Analyses

Fraction	Compound	Conc.Spike Added (ug/l)	Sample Result (ug/l)	Conc. MS (ug/l)	% Recovery	Conc. MSD (ug/l)	% Recovery	RPD	QC Limits	
									RPD	Recovery
Volatile	1,1 Dichloroethane	1000	ND	830	83	820	82	1.23	14	61-145
	Trichloroethene	1000	ND	810	81	840	84	3.64	14	71-120
	Chlorobenzene	1000	ND	1000	100	1000	100	0	13	75-130
	Toluene	1000	ND	1000	110	1000	100	9.52	13	76-125
	Benzene	1000	ND	1100	110	1100	110	0	11	76-127
Base/Neutral	1,2,4-Trichlorobenzene	100	ND	64	64	78	78	19.72	28	39-98
	Acenaphthalene	100	ND	56	56	60	60	6.90	31	46-118
	2,4-Dinitrotoluene	100	ND	13	13	15	15	14.29	38	24-96
	Pyrene	100	ND	37	37	50	50	29.89	31	26-127
	1,4-Dichlorobenzene	100	ND	49	49	65	65	28.07	28	36-97
Acid	Pentachlorophenol	200	ND	91	45.5	84	42	8	50	9-103
	Phenol	200	89	220	65.5	220	65.5	0	42	12-89
	2-Chlorophenol	200	ND	230	115	210	105	9.09	40	27-123
	4-Chloro-3-Methylphenol	200	ND	280	140	240	120	15.38	42	23-97
	4-Nitrophenol	200	ND	ND	0	ND	0	0	50	10-80
Pesticide	Lindane	10	0	11.8	118				15	56-123
	Heptachlor	10	0	5.3	53				20	40-131
	Aldrin	10	0	2.7	27				22	40-120
	Dieldrin	25	0	13.9	56				18	52-126
	Endrin	25	0	20.6	82				21	56-121
	4,4'-DDST	25	0.12	26.4	105				27	38-127
Organophosphates	Phorate	5000	0	5200	104					
	Sulfotepp	5000	0	2700	55					
	Disulfton	5000	0	1300	25					
	Methyl Parathion	NA	0	NA	NA					
	Ethyl Parathion	5000	0	1800	36					
	Famphur	5000	0	910	18					
Herbicide	2,4-D	200	0	194	97					
	2,4,5-TP	200	0	225	112					
	2,4,5-T	200	0	110	54					
	Dinoseb	200	0	149	74					

TABLE 4.6. QC Results Spike/Matrix Spike Duplicate Recovery Inorganic Analyses

S-CUBED ID	Analyte	Conc. Spike Added (mg/l)	Sample Result (mg/l)	Conc. MS (mg/l)	% Recovery
194-4	Fluoride	1.0	0.67	1.60	93
194-4	Sulfide	22.6	65.5	84.8	85
185-3*	Cyanide	4.0	0.04	4.08	101
191-4	Aluminum	5.0	0.80	6.38	112
	Antimony	0.025	0.0022	0.0292	108
	Arsenic	0.025	0.0438	0.0641	81.2
	Barium	1.00	0.273	1.231	95.8
	Beryllium	0.050	0.007	0.052	118
	Calcium	200	216	408	96.2
	Cadmium	0.004	0.000685	0.00844	193
	Chromium	0.020	0.000561	0.00841	39
	Cobalt	0.500	0.094	0.563	131
	Copper	0.200	-0.010	0.242	126
	Iron	15.0	21.07	36.08	100
	Lead	0.010	0.0263	0.0304	41
	Magnesium	40.0	118.5	163.3	112
	Manganese	1.00	1.314	2.730	142
	Mercury	0.005	< DL	0.0024	48
	Nickel	0.30	0.128	0.414	95.3
	Osmium	400	< DL	341.32	85.3
	Potassium	200	613.4	1052.5	220
	Selenium	0.0250	0.0030	0.0143	41.2
	Silver	0.200	-0.0267	0.0444	35.6
	Sodium	500	1075.6	1757.3	136
	Thallium	10.0	0.076	10.32	102
	Tin	10.0	-1.932	9.662	116
	Vanadium	0.0250	0.0170	0.0424	102
	Zinc	0.050	0.1538	0.1636	19.6

* S-CUBED sample number 185-3 (PC-LE-003) used as MS due to matrix problems encountered with 194-4 (NC-LE-01).

TABLE 4.7. QC Results - Surrogate Percent Rocovery

		VOLATILES			SEMIVOLATILES						PESTICIDES
S-CUBED ID	**NUS ID**	Toluene-D5 (88-110)	BFB (88-115)	1,2-Dichloro-Ethane-D5 (78-114)	Nitro-Benzene-D5 (35-114)	2-Fluro-Biphenyl (43-116)	Terphenyl-D14 (33-141)	Phenol-D5 (10-94)	2-Fluro-Phenol (21-100)	2,4,6-Tri-Bromophenol (10-123)	Dibutyl-Chlornedate (24-154)**
185-1	PC-LE-001	106	108	99	***	***	***	***	***	***	115
185-2	PC-LE-002	102	108	101	***	***	***	***	***	***	105
185-3	PC-LE-003	110	111	104	***	***	***	***	***	***	116
185-3D	PC-LE-003A	104	106	100	***	***	***	***	***	***	108
185-4	NY-LE-01	97	104	101	50	96	81	0*	22	112	100
185-5	NY-LE-02	96	97	92	39	100	58	0*	126*	111	101
185-6	NY-LE-03	98	103	109	36	95	70	143*	133*	115	99
188-1	FL-LE-01	134*	59*	53*	56	61	58	101*	80	99	114
188-2	FL-LE-02	126*	102	46*	104	67	55	146*	25	119	120
188-3	FL-LE-03	103	101	96	101	100	55	137*	81	100	105
188-4	SM-LE-001	99	93	64*	84	69	51	134*	83	106	88
188-5	SM-LE-002	97	102	96	86	71	55	130*	75	109	100
188-6	SM-LE-003	94	106	37*	86	72	59	140*	131*	138*	104
191-1	VD-LE-000	102	104	97	102	93	115	100*	86	106	95
191-2	VD-LE-001	97	105	96	110	99	90	123*	91	127*	101
191-3	VD-LE-002	101	99	102	108	102	90	117*	89	120	97
191-4	VD-LE-003	96	103	91	105	102	83	112*	90	130*	101
194-1	NC-LE-01	96	96	87	49	99	57	150*	156*	120	97
194-2	NC-LE-02	110	109	97	55	103	56	150*	137*	149*	117
194-3	NC-LE-03	103	105	36*	61	104	77	141*	145*	129*	141

* Values are outside of contract required QC limits
** Advisory limits only
*** Surrogates not observed at sufficient levels to report

5.0 ANALYTICAL DISCUSSION

5.1 Appendix IX Volatile and Semivolatile GC/MS Analyses

A series of 22 landfill leachate samples were submitted to S-CUBED for GC/MS analyses, with an emphasis on determination of parts per billion levels of EPA Appendix IX substances. This newly compiled listing of hazardous substances is undergoing its first practical application to environmental samples. Thus, new libraries were created, permitting full qualitative and quantitative analyses for both the volatile and semivolatile components on this list.

Due to this present study being the first application of the analysis of the Appendix IX compounds in this laboratory and possibly in any laboratory, several technical difficulties were recognized, which are documented here. These technical difficulties include recognition that a few of the compounds under analysis are not suitable for GC/MS analysis; certain of the compounds are cross reactive with other members of the group; and finally certain of the compounds are unavailable as standards, due in some cases to their extremely hazardous nature.

5.1.1 Volatile Appendix IX Analysis

Compilation of a standard mixture of Appendix IX volatile substances resulted in creation of a GC/MS library describing 57 substances. These substances included 3 internal standards (used as an analytical aid), 3 surrogate compounds (permitting quality control) and 51 out of the 61 hazardous substances on the Appendix IX list. Of the original 61 volatile substances, two were reclassified as semivolatile (pyridine and ethyl methacrylate) and one was too great of a health hazard to permit analysis as a standard (2-chloro-1,3-butadiene). Finally, four compounds (ethyl ether, 2-propen-1-ol, 2-propyl-1-ol and 1,3-dichloro-2-propenal) are inappropriate for purge and trap analysis due to their high solubility in water.

The standard Tenex volatile trap used in these analyses led to difficulties in analyses with four compounds, specifically dichlorofluoromethane, trichlorofluoromethane, trichlorotrifluoroethane (3 types of Freon^{TM}), and methyl isobutyl ketone. A three phase trap, including charcoal as an adsorbent, may more effectively retain these compounds for successful GC/MS analysis. Reactivity of certain of the compounds led to poor analysis performance, most notably with the analysis of 2-chloroethyl vinyl ether, and to a lesser extent with 2-hexanone and 2-butanone.

5.1.2 Semivolatile Appendix IX Analysis

A library of 133 compounds was created to permit analysis of the Appendix IX semivolatile compound group. This library consisted of 6 Internal Standards, 6 Surrogates, and 121 hazardous substances. A certain amount of rearrangement of the Appendix IX list was required in this practical application. Two substances were added from the Volatile list (mentioned above), two compounds were found to exist in two isomeric forms (aramite and isosafrole) additionally lengthening the list of hazardous substances. Several compounds were subtracted from the list, either due to the inappropriate nature of analyzing these compounds by GC/MS or their non-availability as standards. Presented below is a list of problem compounds:

Compound	Explanation
3,3'-Dimethylbenzidine	B
N-Nitroso-di-n-propylamine	C
a,a-Dimethylphenethylamine	B
Phenylenediamine	A
2,4-Toluenediamine	C
o-Toluidine	C
p-Toluidine	C
2-Nitroaniline	B
3-Nitroaniline	B
4-Nitroaniline	B
5-Nitro-o-toluidine	A,B
n-Nitrosopyrrolidine	A
Benzenethiol	A
Dibenzothiophene	C
m-Cresol	B
3,3'-Dimethoxybenzidine	B
1,2-Diphenylhydrazine	B
Hexachlorophene	A
Trichloromethanethiol	A,B
Tris(2,3-Dibromopropyl)phosphate	A,B
Pyridine	A,B
Ethyl Methacrylate	A
p-Dichlorobenzene	B
1,2,3-Trichlorobenzene	C
2,3,5,6-Tetrachlorophenol	C
Diphenyl ether	B
p-Benzoquinone	B
2-Methylnapthalene	B
Dibenzo(a,e)pyrene	B
Dibenzo(1,i)pyrene	B

Explanation: A - Difficulty in GC Component of Analysis
B - No standard available at time of Analysis (Qualitative Analysis Performed: N.A.)
C - Compound removed from list before Analysis.

Additional difficulties were observed with the newly constructed Appendix IX library system. Difficulties with our first internal standard (1,4-Dichlorobenzene-D4) were observed, whereby a suspected interference from the undeuterated, heavy chlorinated isotopic isomers of dichlorobenzenes may have caused quantitation difficulties. Thus corrective action was taken, changing quantitation standard reference for several compounds to a more stable reference compound. Two compounds were apparently unstable or otherwise reactive, providing difficulties in analyses: ethyl methacrylate and hexachlorophene were only detectable in our most concentrated GC/MS standards. The naming of the three naturally occurring dichlorobenzene isomers was found to juxtaposed, however these compounds were not observed in the target samples. Finally, evidence for a cross reaction between certain of the Appendix IX compounds was seen when an intermediate standard solution of sulfur-containing hydrocarbons, the miscellaneous chlorinated ethanes/propanes, chlorinated butanes/pentanes, chlorinated benzenes/napthalenes, haloethers, phthalate esters and polynuclear aromatic hydrocarbons were mixed and left in a laboratory freezer overnight, turning blue.

5.1.2 Analytical Review

The composition of many of the samples under analysis resulted in significant analytical challenges. The following samples were observed to be comprised of large amounts of organic acids and related polar compounds, consistent with degrading natural organic matter resulting in difficulties in analysis due to chromatographic interference, whereby the retention of target compounds may be shifted by unpredictable amounts. The solution to this type of problem is re-extraction at the following recommended levels, and subsequent re-examination by GC/MS for absolutely certain analytical data.

Overloaded Samples

Sample	Recommended Re-Extraction Volume
194-1A	100 ml.
194-1A	100 ml.
194-3A	100 ml.
185-4	100 ml.
188-5A	100 ml.
188-4A	100 ml.
188-6A	100 ml.
185-5	10 ml.
185-6	10 ml.
188-1A	10 ml.
188-2A	10 ml.
185-1	10 ml.
185-2	10 ml.
185-3	10 ml.

Certain of the samples presented other analysis difficulties. Four such samples provided solid extracts for GC/MS analyses. These were diluted to a larger extent (e.g. 1:60 vs. 1:2). As a result of these dilutions, the surrogates for samples 185-1, 185-2, 185-3 and 185-3D were not observed at sufficient levels to report.

5.1.4 Dioxin Screening

Screening for dioxin contamination was approached by analysis of a pure dioxin standard, and subsequent examination of the GC/MS data for this compound. Analysis of 32 nanograms (0.000000032 grams) of the 2,3,7,8-TCDD isomer provided an exact mass spectrum and retention time as produced by our GC/MS equipment. These data were used within a wide window to determine if this isomer, or any similar compounds, were detectable in the NUS samples. None were detected in any of the samples associated with this project.

5.2 Metals Analysis

All correlation coefficients are greater than 0.955. Instrument calibration linearity is verified.

IDL are 1 to 15 times optimum as specified in SW-846, p. 7000-02, Table 1'. (Aluminum was the worst case; see below regarding osmium).

MDL are 0.2 to 7.5 times ground water monitoring detection limits specified in SW-846, p. TWO-29, Table 2-15 (Aluminum worst case).

EPA QC check sample results are all within 95-120% of true values.

Precision, as measured by duplicate analysis, is within 15% RDP for all analytes for which sufficient native analyte concentration exists. For analyte concentrations at or near MDL, RPD values of 20% to 60% are typical, while for analyte concentrations well below MDL, RPD values up to 200% are found.

Accuracy, as measured by matrix spike recoveries, is within 80-131% recovery for most analytes. Exceptions: manganese (142%), whose anomalously high recovery cannot be explained at this time; selenium (41.2%), whose recovery is probably due to volatilization loss during digestion; zinc (19.6%), whose recovery is below MDL is therefore quantitatively indistinguishable from zero, and probably indicative of a laboratory spike omission error; silver (35.6%), whose recovery is probably due to a high chloride concentration native to the sample; calcium (193%), whose high recovery is most likely due to contamination; chromium (39%), whose low recovery is probably due to high chloride concentration; lead (41%) is probably due to high chloride as well; potassium (220%) whose high recovery is probably due to extremely high dilution error or possible contamination.

In summary, the sample matrix contained many interferents, such as high concentrations of salts (chloride), organic matter, and observable surfactants. In order to dilute out these interferents for low level analytes, detection limits are sacrificed, rendering the use of GFAA pointless. High chloride causes early volatilization in many furnace metals, hence, low recoveries for chromium, lead, and selenium. Chloride can also cause enhancement of signal for flame metals which may explain high recoveries for many flame metals.

APPENDIX G

VERSAR - TRACE ELEMENT RESULTS REPORT INCLUDING QA/QC DATA

Versar INC.
Laboratory Operations
Trace Metals Section

March 17, 1987

ANALYSIS NARRATIVE

Project: 5030.003.02 - 1,2 (Total Metals)
Title: NUS EPA TSD Regulations Support
Client: EPA

This is an analytical task in support of the NUS EPA TSD Regulations Support project which consisted of two solid (ash) matrix sample The samples were received February 12, 1987, and digested for FAA and ICP analyses by Method 3050 of Test Methods for Evaluating Solid Waste, SW-846, Third Edition, September 1986, on February 27, 1987. No proble were noted for the digestions.

The samples were analyzed by ICP on March 16, 1987. All reference and check standard values were within ten percent windows. Negative background correction greater than or equal to the detection limit was noted for chromium for the calibration blank, but the negative value wa not significant enough to justify recalibration for this analyte. Iron was present in the reagent blank at 34 ppb. This is slightly higher th the normal level but adds an insignificant positive bias to the reporte iron results because of the large amounts of this analyte found in both samples. Duplicate precision, which was greater than twenty percent fo all analytes except chromium, indicate that the sample number NY ASH 01 is non-homogeneous. Because of the non-homogeneity of the sample, spike recoveries, which ranged from none to several thousand percent, are mea ingless and no conclusions can be drawn from the spike and duplicate spike recoveries.

Furnace AA analytes were analyzed between March 4 and 9, 1987. Al reference and check standards were within twenty percent windows. Calibration and reagent blanks were clean. Selenium was reported at a higher detection limit for sample and duplicate because of interference so no conclusions can be drawn about method precision for this analyte. The 43 percent RPD reported for the arsenic sample and duplicate result again indicate that sample number NY ASH 01 was non-homogeneous. Spike and duplicate spike recoveries for selenium and arsenic are meaningless because of interferences and non-homogeneity, respectively.

The samples were digested for Hg CVAA analysis according to the SW-846 reference above, Method 7471, on February 26, 1987, and analyzed the same day. All reference and check standards were within twenty percent windows. Calibration and reagent blanks were clean. Sample an duplicate RPD was 9.5 percent and spike recovery was 100 percent but sample homogeneity for mercury should be suspect because of the results for other analytes.

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Shift Supervisor

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Versar INC.

LABORATORY OPERATIONS
TRACE METALS SECTION

March 16, 1987

ANALYTICAL RESULTS

Project: 5030.3.2 - 1&2
Lab No.: 22394
Field No.: NY ASH 01

(Conc. in: mg/kg)
WET WEIGHT

ICP Analysis		AA Analysis	
Parameter	Sample Concentration	Parameter	Sample Concentration
Cadmium	14.8	Arsenic	11.4
Chromium	55.2	Mercury	0.10
Copper	226.	Selenium	< 5. *
Iron	18,900.		
Lead	630.		
Manganese	508.		
Nickel	144.		
Zinc	1510.		

Comments: * Detection limit changed due to dilution because of interference. PERCENT MOISTURE = 58.%

Robert Maxfield,
Lab Manager

Procedure in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Third Edition
USEPA, Washington D.C., 1986

Versar INC.

LABORATORY OPERATIONS
TRACE METALS SECTION

March 16, 1987

ANALYTICAL RESULTS

Project: 5030.3.2 - 1&2
Lab No.:23004
Field No.: NC ASH 01

(Conc. in: mg/kg)
WET WEIGHT

ICP Analysis		AA Analysis	
Parameter	Sample Concentration	Parameter	Sample Concentration
Cadmium	8.6	Arsenic	19.6
Chromium	28.2	Mercury	3.8
Copper	5100.	Selenium	< 5. *
Iron	11,900.		
Lead	3240.		
Nickel	498.		
Manganese	352.		
Zinc	3750.		

Comments: * Detection limit changed due to dilution because of interference. PERCENT MOISTURE = 72 %

Robert Maxfield,
Lab Manager

Procedure in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Third Edition
USEPA, Washington D.C., 1986

Versar INC

LABORATORY OPERATIONS
TRACE METALS SECTION

March 16, 1987

QUALITY ASSURANCE DATA

Project: 5030.3.2 - 1&2

ICP Analysis
(Conc. in: ug/l)

	Ref. Std.	Blank Results	Check Std.	Dup #1 Field #: NY ASH 01 **	Dup #2 Field #:	Spike #1 Field #: NY ASH 01 **	Dup Spk #1 Field #: **
	Found True % Rec.	Calb Blk Reg Blk 1 Reg Blk 2	Found True % Rec.	Sample Duplicate RPD	Sample Duplicate RPD	Sample Spike Added % Rec.	Sample Spike Added % Rec.
Cd	256.0 254.6 100.5%	< 10. < 10.	260.0 254.6 102.1%	14.8 8.7 51.9%		14.8 99.7 100.0 84.9%	14.8 99.9 100.0 85.1%
Cr	230.0 252.0 91.3%	< 18. * < 8.	234.0 252.0 92.9%	55.2 52.0 6.0%		55.2 161.0 100.0 105.8%	55.2 1390.0 100.0 1334.8%
Cu	198.0 200.0 99.0%	< 10. < 10.	199.0 200.0 99.5%	226.0 127.0 56.1%		226.0 340.0 200.0 57.0%	226.0 666.0 200.0 220.0%
Fe	209.0 200.0 104.5%	< 10. 34.0	217.0 200.0 108.5%	18900.0 8710.0 73.8%		18900.0 28300.0 1000.0 ***	18900.0 20300.0 1000.0 ***
Mn	199.0 200.0 99.5%	< 2.0 < 2.0	203.0 200.0 101.5%	508.0 403.0 23.1%		508.0 801.0 200.0 146.5%	508.0 714.0 200.0 103.0%
Ni	198.0 200.0 99.0%	< 15. < 15.	202.0 200.0 101.0%	144.0 53.0 92.4%		144.0 328.0 200.0 92.0%	144.0 7440.0 200.0 3648.0%
Pb	548.0 553.0 99.1%	< 70. < 70.	570.0 553.0 103.1%	630.0 254.0 85.1%		630.0 2090.0 200.0 730.0%	630.0 978.0 200.0 174.0%
Zn	204.0 200.0 102.0%	< 3. < 3.	206.0 200.0 103.0%	1510.0 542.0 94.3%		1510.0 1400.0 200.0 0.0%	1510.0 2210.0 200.0 350.0%

* Detection limit changed to account for high negative background correction.

** Conc. in: mg/kg

*** Spike < 10% of sample conc.

Versar INC

LABORATORY OPERATIONS
TRACE METALS SECTION

March 16, 1987

QUALITY ASSURANCE DATA

Project: 5030.3.2 - 1&2

AA Analysis
(Conc. in: ug/l)

	Ref. Std.	Blank Results	Check Std.	Dup #1 Field #: NY ASH 01 **	Dup #2 Field #:	Spike #1 Field #: NY ASH 01 **	Dup Spk #1 Field #: NY ASH 01 **
	Found True % Rec.	Calb Blk Reg Blk 1 Reg Blk 2	Found True % Rec.	Sample Duplicate RPD	Sample Duplicate RPD	Sample Spike Added % Rec.	Sample Spike Added % Rec.
As	110.0	< 10.	112.0	11.4		11.4	11.4
	100.0	< 10.	100.0	7.4		44.3	41.5
	110.0%		112.0%	42.6%		50.0	50.0
						65.8%	60.2%
Hg	3.9	< 0.2	2.5	0.10		0.10	
	4.8	< 0.2	2.5	0.11		1.10	
	81.3%		100.0%	9.5%		1.0	
						100.0%	
Se	21.0	< 5.	50.0	< 5. *		< 5. *	< 5. *
	21.8	< 5.	50.0	< 5. *		27.9	36.3
	96.3%		100.0%	-		50.0	50.0
						55.8%	72.6%

* Detection limit changed due to dilution because of interference.
** Conc. in: mg/kg

Versar INC.
Laboratory Operations
Trace Metals Section

March 17, 1987

ANALYSIS NARRATIVE

Project: 5030.003.02 - 1,2 (EP Tox)
Title: NUS EPA TSD Regulations Support
Client: EPA

This is an analytical task in support of the NUS EPA TSD Regulations Support project which consisted of two solid (ash) matrix sampl The samples were received February 12, 1987, and subjected to the Extr ion Procedure Toxicity in accordance with Method 1310 of Test Methods for Evaluating Solid Waste, SW-846, Third Edition, September 1986, on February 28, 1987. Because of the limited sample volume available, no method duplicates were run for the procedure. No problems were noted for the extraction.

The extracts were digested for FAA and ICP analyses by Methods 7060/7740 and 3010 of Test Methods for Evaluating Solid Waste, SW-846, Third Edition, September 1986, on March 9 and 10, 1987. No problems were noted for the digestion.

The samples were analyzed by ICP on March 12, 1987. All referenc and standard values were within twenty percent windows. Barium was pr ent in the reagent blank at 68 ppb. This is a significant amount whic is probably due to cross contamination from the samples during the digestion procedure. Although the accuracy of the results could be effec by as much as eight percent, the reagent blank was not redigested beca the samples would not exceed the maximum contaminant level due to this experimental error. Duplicate precision for reported values above detection limits were within twenty percent windows with the exception of arsenic; however, both sample and duplicate values are approximately twice the detection limit and greater variation in precision is expect at this concentration level. Spike recoveries were within twenty percent windows for all analytes except barium which was 43 percent. This indicates the probable existence of chemical interferences for this ana yte. The level of interference for barium does not appear to be significant enough to alter the determination that the samples are not tox for barium.

Selenium was analyzed by furnace AA on March 11, 1987. All refer and check standards were within twenty percent windows. The calibrati and reagent blank were clean. The detection limit for both samples va raised by a factor of ten due to dilution because of interference as evidenced by poor replicate burn precision and MSA recoveries. The sa and duplicate concentrations were reported as less than the elevated d ection limit; therefore, no RPD's are available. Spike recovery for the analysis was 92 percent.

Versar INC

March 17, 1987

The samples were digested for Hg CVAA analysis according to the SW-846 reference above, Method 7470, on March 11, 1987, and analyzed the same day. All reference and check standards were within twenty percent windows. Calibration and reagent blanks were clean. Sample and duplicat were reported at less than detection limits so no conclusions can be made concerning the precision of the method.

Steven L. Helberg
Steven L. Helberg
Shift Supervisor

Versar INC.
LABORATORY OPERATIONS
TRACE METALS SECTION

March 16, 1987

EXTRACTION PROCEDURE TOXICITY ANALYTICAL RESULTS

Project: 5030.3.2-1&2

EP TOX
(Conc. in: mg/L)

Field Sample #	Lab #	Arsenic	Barium	Cadmium	Chromium
1. NY ASH 01	22392	< 0.02	0.832	0.195	< 0.02
2. NC ASH 01	23002	0.049	0.820	0.275	0.043
3.					
4.					
5.					
EP Tox. Max. Conc.		5.0	100.	1.0	5.0

Field Sample #	Lab #	Lead	Mercury	Selenium	Silver
1. NY ASH 01	22392	3.17	< 0.002	< 0.05*	< 0.02
2. NC ASH 01	23002	48.8	< 0.002	< 0.05*	< 0.02
3.					
4.					
5.					
EP Tox. Max. Conc.		5.0	0.2	1.0	5.0

Comments: * Detection limit changed due to dilution because of interference.

Procedures in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Third Edition
USEPA, Washington, D.C., 1986

Robert Maxfield
Lab Manager

Versar INC
LABORATORY OPERATIONS
TRACE METALS SECTION

March 16, 1987

EXTRACTION PROCEDURE TOXICITY QUALITY ASSURANCE DATA

Project: 5030.3.2-1&2

EP TOX
(Conc. in: mg/L)

	Ref. Std.	Blank Results	Check Std.	Dup #1 Field #: NC ASH 01	Dup #2 Field #:	Spike #1 Field #: NY ASH 01	Spike #2 Field #:
	Found True % Rec.	Calb Blk Reg Blk 1 Reg Blk 2	Found True % Rec.	Sample Duplicate RPD	Sample Duplicate RPD	Sample Spike Added % Rec.	Sample Spike Added % Rec.
Ag	0.060 0.063 95.2%	< 0.02 < 0.02	0.058 0.063 92.1%	< 0.02 < 0.02 -		< 0.02 0.819 1.00 81.9%	
As	0.257 0.246 104.5%	< 0.02 < 0.02	0.253 0.246 102.8%	0.049 0.040 20.2%		<0.02 1.66 2.0 83.0%	
Ba	0.288 0.280 102.9%	< 0.02 0.068	0.285 0.280 102.0%	0.820 0.800 2.5%		0.832 1.26 1.00 42.8%	
Cd	0.242 0.2546 95.1%	< 0.02 < 0.02	0.244 0.2546 95.8%	0.275 0.271 1.5%		0.195 1.04 1.00 84.5%	
Cr	0.217 0.252 86.1%	< 0.02 < 0.02	0.214 0.252 84.9%	0.043 0.043 0.0%		< 0.02 0.849 1.00 84.9%	
Hg ••	0.0034 0.0040 85.0%	< 0.002 < 0.002	0.0021 0.0025 84.0%	< 0.002 < 0.002 -			
Pb	0.482 0.553 87.2%	< 0.02 < 0.02	0.515 0.553 93.1%	48.8 48.1 1.4%		3.170 4.860 2.00 84.5%	
Se ••	0.043 0.050 85.7%	< 0.005 < 0.005	0.051 0.050 102.0%	< 0.05 • < 0.05 • -		< 0.05* 0.046 0.050 92.0%	

• Detection limit changed due to dilution because of interference.
•• AA Analysis

Versar INC.
Laboratory Operations
Trace Metals Section

March 17, 1987

ANALYSIS NARRATIVE

Project: 5030.003.02 - 1,2 (TCLP)
Title: NUS EPA TSD Regulations Support
Client: EPA

This is an analytical task in support of the NUS EPA TSD Regulations Support project which consisted of two solid (ash) matrix samples The samples were received February 12, 1987, and subjected to the Toxicity Characteristic Leachate Procedure in accordance with the Federal Register, Volume 51, Number 216, Page 40643, November 7, 1986, on February 27, 1987. Because of the limited sample volume available, no method duplicates were run for the procedure. No problems were noted fc the procedure.

The extracts were digested for FAA and ICP analyses by Methods 7060/7740 and 3010 of Test Methods for Evaluating Solid Waste, SW-846, Third Edition, September 1986, on March 9 and 10, 1987. No problems were noted for the digestion.

The samples were analyzed by ICP on March 12, 1987. All reference and standard values were within twenty percent windows. Lead was present in the reagent blank at 748 ppb. This is a significant amount which is probably due to cross contamination from the samples during the digestion procedure. It should be noted that the lead levels reported coul be positively biased by at least the reagent blank contamination level. Duplicate precision for reported values above detection limits were vith twenty percent windows with the exception of arsenic which was 46 percen therefore, accuracy of the reported results is questionable. Spike recoveries were within twenty percent windows for all analytes.

Selenium was analyzed by furnace AA on March 10 and 16, 1987. All reference and check standards were within twenty percent windows. The calibration and reagent blank were clean. The detection limit for both samples was raised by a factor of five due to dilution because of interference as evidenced by poor replicate burn precision and MSA recoveries The sample and duplicate concentrations were reported as less than the elevated detection limit; therefore, no RPD's are available. Spike recovery for the analysis was 70 percent. This indicates a possible negative bias for reported results due to interferences.

The samples were digested for Hg CVAA analysis according to the SW-846 reference above, Method 7470, on March 11 and 12, 1987, and analyzed the same day for each digestion. All reference and check standards were within twenty percent windows. Calibration and reagent blanks were clean. Values reported for sample and duplicate were the same and indicated good method precision.

Steven L. Helberg

Steven L. Helberg
Shift Supervisor

Versar INC.
LABORATORY OPERATIONS
TRACE METALS SECTION

March 16, 1987

TOXICITY CHARACTERISTIC LEACHATE PROCEDURE ANALYTICAL RESULTS

Project: 5030.3.2 - 1&2

TCLP
(Conc. in: mg/L)

Field Sample #	Lab #	Arsenic	Barium	Cadmium	Chromium
1. NY ASH 01	22392	0.203	0.633	0.155	0.270
2. NC ASH 01	23002	0.169	0.924	0.384	< 0.1 *
3.					
4.					
5.					

Field Sample #	Lab #	Lead	Mercury	Selenium	Silver
1. NY ASH 01	22392	9.58	< 0.002	< 0.025 *	< 0.02
2. NC ASH 01	23002	240.	0.044	< 0.025 *	< 0.1 *
3.					
4.					
5.					

Comments: * Detection limit changed due to dilution because of high amounts of dissolved solids.

Procedures in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Third Edition
USEPA, Washington, D.C., 1986

Robert Maxfield
Lab Manager

Versar INC.

LABORATORY OPERATIONS
TRACE METALS SECTION

March 16, 1987

TOXICITY CHARACTERISTIC LEACHATE PROCEDURE QUALITY ASSURANCE DATA

Project: 5030 3.2 - 1&2

TCLP
(Conc. in: mg/L)

	Ref. Std.	Blank Results	Check Std.	Dup #1 Field #: NC ASH 01	Dup #2 Field #:	Spike #1 Field #: NY ASH 01	Spike #2 Field #:
	Found True % Rec.	Calb Blk Reg Blk 1 Reg Blk 2	Found True % Rec.	Sample Duplicate RPD	Sample Duplicate RPD	Sample Spike Added % Rec.	Sample Spike Added % Rec.
Ag	0.058 0.063 92.1%	< 0.02 < 0.02	0.061 0.063 96.8%	< 0.01 • < 0.01 • -		< 0.01 • 0.805 1.00 80.5%	
As	0.253 0.246 102.8%	< 0.02 < 0.02	0.240 0.246 97.6%	0.169 0.106 45.8%		0.203 1.85 2.00 82.4%	
Ba	0.285 0.280 101.8%	< 0.02 0.335	0.283 0.280 101.1%	0.924 0.804 13.9%		0.633 1.54 1.00 90.7%	
Cd	0.244 0.2546 95.8%	< 0.02 < 0.02	0.236 0.2546 92.7%	0.384 0.374 2.6%		0.155 0.998 1.00 84.3%	
Cr	0.214 0.252 84.9%	< 0.02 < 0.02	0.217 0.252 86.1%	< 0.01 • < 0.01 • -		< 0.1 • 1.14 1.00 114.0%	
Hg ••	0.0034 0.0040 85.0%	< 0.002 < 0.002	0.0023 0.0025 92.0%	0.044 0.044 0.0%			
Pb	0.516 0.553 93.3%	< 0.02 0.748	0.511 0.553 92.4%	240.0 217.0 10.1%		9.6 11.50 2.00 96.0%	
Se ••	0.042 0.0500 84.0%	< 0.005 < 0.005	0.054 0.050 108.0%	< 0.025 • < 0.025 • -		< 0.025 • 0.035 0.050 70.0%	

• Detection limit changed due to dilution because of interference.
•• AA Analysis

Versar INC.
Laboratory Operations
Trace Metals Section

March 17, 1987

ANALYSIS NARRATIVE

Project: 5030.003.02 - 2 (SW924)
Title: NUS EPA TSD Regulations Support
Client: EPA

This is an analytical task in support of the NUS EPA TSD Regulations Support project which consisted of one solid (ash) matrix sample. The samples were received February 12, 1987, and subjected to the deionized water leachate procedure as outlined in A Procedure for Estimating Monofilled Solid Waste Leachate Composition, SW-924, Second Edition, January 1986, on March 3, 1987. Because of the limited sample volume available, no method duplicates were run for the procedure. No problems were noted for the procedure.

The extracts were digested for FAA and ICP analyses by Methods 7060/7740 and 3010 of Test Methods for Evaluating Solid Waste, SW-846, Third Edition, September 1986, on March 9 and 10, 1987. No problems were noted for the digestions.

The samples were analyzed by ICP on March 12, 1987. All reference and check standards were within twenty percent windows. The calibration and reagent blank were clean. Duplicate precision for values reported above detection limits were within twenty percent windows. Spike recoveries were within twenty percent windows except for lead which could not be reported because the spike was less than ten percent of the sample concentration.

Selenium was analyzed by furnace AA on March 10, 1987. All referenc and check standards were within twenty percent windows. The calibration and reagent blank were clean. Duplicate precision could not be determine because sample and duplicate were reported below detection limit. Spike recovery for the analysis was 96 percent.

The extracts were digested for Hg CVAA analysis according to the SW-846 reference above, Method 7470, on March 11, 1987, and analyzed the same day. All reference and check standards were within twenty percent windows. Calibration and reagent blanks were clean. Sample and duplicate were reported below detection limits so no conclusions about method precision can be made.

Steven L Helberg
Steven L. Helberg
Shift Supervisor

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Versar INC.
LABORATORY OPERATIONS
TRACE METALS SECTION

March 16, 1987

EXTRACTION PROCEDURE ANALYTICAL RESULTS

Project: 5030.3.2 - 1&2

SW 924
(Conc. in: mg/L)

Field Sample #	Lab #	Arsenic	Barium	Cadmium	Chromium
1. NC ASH 01	23002	0.026	3.29	< 0.02	< 0.02
2.					
3.					
4.					
5.					

Field Sample #	Lab #	Lead	Mercury	Selenium	Silver
1. NC ASH 01	23002	75.4	< 0.002	< 0.005	< 0.02
2.					
3.					
4.					
5.					

Comments:

Procedures in accordance with:
Test Methods for Evaluating
Solid Waste, SW-846, Third Edition
USEPA, Washington, D.C., 1986

Robert Maxfield
Lab Manager

Versar INC
LABORATORY OPERATIONS
TRACE METALS SECTION

March 16, 1987

EXTRACTION PROCEDURE QUALITY ASSURANCE DATA

Project: 5030.3.2 - 1&2

SW 924
(Conc. in: mg/L)

	Ref. Std.	Blank Results	Check Std.	Dup #1 Field #: NC ASH 01	Dup #2 Field #:	Spike #1 Field #: NY ASH 01	Spike #2 Field #:
	Found True % Rec.	Calb Blk Reg Blk 1 Reg Blk 2	Found True % Rec.	Sample Duplicate RPD	Sample Duplicate RPD	Sample Spike Added % Rec.	Sample Spike Added % Rec.
Ag	0.058 0.060 96.7%	< 0.02 < 0.02	0.061 0.060 101.7%	< 0.02 < 0.02 -		< 0.02 0.830 1.00 83.0%	
As	0.253 0.246 102.8%	< 0.02 < 0.02	0.240 0.246 97.6%	0.026 < 0.02 -		0.026 1.67 2.00 82.2%	
Ba	0.285 0.280 101.8%	< 0.02 < 0.02	0.283 0.280 101.1%	3.290 3.250 1.2%		3.29 4.18 1.00 89.0%	
Cd	0.244 0.2546 95.8%	< 0.02 < 0.02	0.236 0.2546 92.7%	< 0.02 < 0.02 -		< 0.02 0.868 1.00 86.8%	
Cr	0.214 0.252 84.9%	< 0.02 < 0.02	0.217 0.252 86.1%	< 0.02 < 0.02 -		< 0.02 0.876 1.00 87.6%	
Hg **	0.0034 0.0040 85.0%	< 0.002 < 0.002	0.0021 0.0025 84.0%	< 0.002 < 0.002 -			
Pb	0.516 0.553 93.3%	< 0.02 < 0.02	0.511 0.553 92.4%	75.4 73.6 2.4%		75.40 76.50 2.00 *	
Se **	0.042 0.050 84.0%	< 0.005 < 0.005	0.054 0.050 108.0%	< 0.005 < 0.005 -		< 0.005 0.048 0.050 96.0%	

* Spike < 10% of sample concentration.
** AA Analysis

Versar INC.

GENERAL INORGANIC CHEMISTRY SECTION
ANALYSIS REPORT

PROJECT : 5030.3.2
BATCH : 2

DATE : 16-Mar-87
PAGE : 1

LAB #	SAMPLE ID	Petroleum Hydrocarbon (mg/l)	TOC (mg/l)		
23002	NY ASH 01				
	EP	<0.2			
	TCLP	<0.2			
	SW924	<0.2	30.1		

LABORATORY MANAGER

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GENERAL INORGANIC CHEMISTRY
QUALITY ASSURANCE REPORT

DATE: 16-Mar-87
PAGE: 1
OF SAMPLES: 3

PROJECT: 5030.3.2
BATCH: 1&2
PARAMETER: Pet.Hydro (mg/l)

I. INITIAL CALIBRATION VERIFICATION	REFERENCE STANDARD SOURCE WP 379 #3 (O&G)	FOUND	16.4
		TRUE	13.6
		% RECOVERY	121%
	METHOD DETECTION	LIMIT	0.20
II. CONTINUING CALIBRATION VERIFICATION	BLANK 1	RESULTS	<0.20
	BLANK 2	RESULTS	
	STANDARD 1 SOURCE WP 379 #3 (O&G)	FOUND	17.1
		TRUE	13.6
		% RECOVERY	126%
	STANDARD 2 SOURCE	FOUND	
		TRUE	
		% RECOVERY	
III. DUPLICATE SAMPLE RESULTS	DUPLICATE 1 SAMPLE ID	SAMPLE RESULT	
		DUPLICATE RESULT	
		RPD %	
	DUPLICATE 2 SAMPLE ID	SAMPLE RESULT	
		DUPLICATE RESULT	
		RPD %	
IV. SPIKED SAMPLE RESULT	SPIKED SAMPLE ID NY ASH 01 EP	$\bar{X}$ SAMPLE RESULT	<0.2
		SPIKE RESULT	1.17
		SPIKE ADDED	1.0
		% RECOVERY	117%

Versar INC.

GENERAL INORGANIC CHEMISTRY
QUALITY ASSURANCE REPORT

DATE: 16-Mar-87
PAGE: 1
OF SAMPLES: 1

PROJECT: 5030.3.2
BATCH: 2

PARAMETER: TOC (mg/l)

I. INITIAL CALIBRATION VERIFICATION	REFERENCE STANDARD SOURCE WP 1284 #3	FOUND	5.70
		TRUE	6.12
		% RECOVERY	93%
	METHOD DETECTION	LIMIT	0.20
II. CONTINUING CALIBRATION VERIFICATION	BLANK 1	RESULTS	0.35
	BLANK 2	RESULTS	
	STANDARD 1 SOURCE WP 1284 #3	FOUND	6.04
		TRUE	6.12
		% RECOVERY	99%
	STANDARD 2 SOURCE	FOUND	
		TRUE	
		% RECOVERY	
III. DUPLICATE SAMPLE RESULTS	DUPLICATE 1 SAMPLE ID NY ASH 01 SW 924	SAMPLE RESULT	30.3
		DUPLICATE RESULT	30.0
		RPD %	1%
	DUPLICATE 2 SAMPLE ID	SAMPLE RESULT	
		DUPLICATE RESULT	
		RPD %	
IV. SPIKED SAMPLE RESULT	SPIKED SAMPLE ID NY ASH 01 SW 924	$\bar{X}$ SAMPLE RESULT	30.2
		SPIKE RESULT	59.8
		SPIKE ADDED	30.0
		% RECOVERY	99%

GENERAL INORGANIC CHEMISTRY SECTION
ANALYSIS REPORT

PROJECT : 5030.3.2
BATCH : 1

DATE : 16-Mar-87
PAGE : 1

LAB #	SAMPLE ID	Petroleum Hydrocarbon (mg/l)	TOC (mg/l)		
22392	NY ASH 01				
	EP	<0.2			
	TCLP	<0.2			
	SW924	insuff. sample	insuff. sample		

LABORATORY MANAGER

Versar INC.

GENERAL INORGANIC CHEMISTRY
QUALITY ASSURANCE REPORT

DATE: 16-Mar-87
PAGE: 1
OF SAMPLES: 3

PROJECT: 5030.3.2
BATCH: 1&2

PARAMETER: Pet.Hydro (mg/l)

I. INITIAL CALIBRATION VERIFICATION	REFERENCE STANDARD SOURCE WP 379 #3 (O&G)	FOUND	16.4
		TRUE	13.6
		% RECOVERY	121%
	METHOD DETECTION	LIMIT	0.20
II. CONTINUING CALIBRATION VERIFICATION	BLANK 1	RESULTS	<0.20
	BLANK 2	RESULTS	
	STANDARD 1 SOURCE WP 379 #3 (O&G)	FOUND	17.1
		TRUE	13.6
		% RECOVERY	126%
	STANDARD 2 SOURCE	FOUND	
		TRUE	
		% RECOVERY	
III. DUPLICATE SAMPLE RESULTS	DUPLICATE 1 SAMPLE ID	SAMPLE RESULT	
		DUPLICATE RESULT	
		RPD %	
	DUPLICATE 2 SAMPLE ID	SAMPLE RESULT	
		DUPLICATE RESULT	
		RPD %	
IV. SPIKED SAMPLE RESULT	SPIKED SAMPLE ID NY ASH 01 EP	$\bar{X}$ SAMPLE RESULT	<0.2
		SPIKE RESULT	1.17
		SPIKE ADDED	1.0
		% RECOVERY	117%

APPENDIX H

VERSAR - ORGANIC RESULTS REPORT INCLUDING QA/QC DATA

Versar INC.

March 30, 1987

I. Narrative
Versar Project 5030.3.2 - Batch 1 & 2

This report contains the analytical data for semivolatile analysis of leachate samples generated from ash samples which arrived at Versar on February 12, 1987. Analyses for polychlorinated biphenyls (PCB's) by GC/MS were also performed. A sample list follows:

SAMPLE LIST

	Leachate			Ash
	EP TOX	TCLP	SW924	PCB
NY ASH 01	X	X		X
NC ASH 01	X	X	X	X

GC/MS instrument calibration using DFTPP met contract requirements for semivolatile analyses. SPCC and CCC criteria were met for semivolatile initial calibration curves and continuing calibration check standards. All standards, reagent blanks, and samples were analyzed during the twelve hour period that followed instrument calibration.

The leachate samples were derived from the Toxicity Characteristic Leachate Procedures (TCLP) outlined in the US Federal Register, (June 13, 1986 40 CFR Parts 261, 271, and 302; November 7, 1987 40 CFR Part 260 et al.) Leachate samples were also prepared according to the EPTOX procedures and from the EPA Office of Solid Waste Method SW924. GC/MS analyses of these leachate samples followed the EPA CLP protocol for semivolatile analysis of water samples.

Method SW924 analysis could not be performed for sample NY ASH 01 due to the limited amount of raw sample supplied to the laboratory. A memo documenting the problem follows this narrative.

Quality control samples analyzed in association with the leachate samples included individual reagent blanks for each leachate and extraction procedure. Due to the limited volume of leachate, no duplicate nor matrix spiked QC analyses could be performed. However, a method standard was analyzed to verify acceptable extraction efficiency for the EPA CLP protocol MS/MSD base-neutral and acid compounds.

All base-neutral surrogate standard compounds met recovery limits specified by the EPA CLP protocol for the analysis of water samples. Low recoveries of the acid surrogate compounds were noted in both samples extracted with the TCLP and EPTOX leachate methods. Acid surrogate recoveries were acceptable in the reagent blanks extracted in conjunction with these methods.

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Versar INC.

Project 5020.3.2
Batches 1 & 2
ASH: Leachate
PCB

Benzoic acid was the only HSL target compound present in these samples; in some analyses, the presence of this organic acid could not be confirmed by CLP mass spectral identification criteria -- therefore, in these instances, a tentative identification was performed using the EPA/NBS mass spectral database library.

PCB analyses utilized EPA Method 680, Determination of pesticides and PCB's in water and soil/sediment by GC/MS. Both samples listed above, NY-ASH-01 and NC-ASH-01 were analyzed in addition to analysis of a duplicate sample and a matrix spiked sample. Labeled chlorine PCB isotopes were used for the matrix spike material. Recovery of surrogate compounds and matrix spiked PCBs were acceptable. No PCBs were confirmed present in either sample.

Please contact Mike Buchanan, Mass Spectrometry Section Chief, or me, should you have any questions or require additional information pertaining to the semivolatile or PCB analyses contained in this report.

Sincerely,

Lawrence P. Pollack

Lawrence P. Pollack
GC/MS Data Quality Manager
Laboratory Operations

M E M O R A N D U M

TO: Bill Nivens

FROM: Chris Pappas CP

DATE: 27-Feb-87

SUBJECT: 5030.3.2-1 &2 Extractions

I have calculated that we will need the following amount of sample to perform the required extractions:

to yield 5l EP Tox extract, 250g
to yield 5l TCLP extract, 250g
to yield 5l SW924 extract, 500g
for a grand total of 1000g.

Note that this does not take duplicate extractions into account.

The problem is that there are approx. 610g of sample 22392 and 1160g of sample 23002. After informing Mark Carkhuff of this, He set the following extraction priorities: EP Tox, TCLP, SW924.

By excluding an extraction duplicate, sample 23002 will have all 3 extractions done. If there are any problems see me.

cc: Carkhuff
file

PROJECT: 5030.3.2
BATCHES: 1,2
PCB ASH / METHOD 680 / GC/MS

SAMPLE RESULT SUMMARY

SAMPLE#	LAB#	PCB DETECTED	CONC. (ug/kg)
RB917	AB3706	NONE	N/A
NC-ASH-01	23003	NONE	N/A
NC-ASH-01-Y	23003Y	NONE	N/A
NC-ASH-01-Z	23003Z	NONE	N/A
NY-ASH-01	22393	NONE	N/A

PROJECT: 5030.3.2
BATCHES: 1,2
PCB ASH / METHOD 680 / GC/MS

PCB SURROGATE RECOVERY SUMMARY

SAMPLE#	LAB#	SS#1	SS#2	SS#3	SS#4
RB917	AB3706	21	93	96	103
NC-ASH-01	23003	60	81	82	87
NC-ASH-01-Y	23003Y	59	96	93	91
NC-ASH-01-Z	23003Z	64	91	91	94
NY-ASH-01	22393	67	100	82	56

*LABELLED PCB SURROGATES:
*SS#1= 4-MONOCHLOROBIPHENYL
*SS#2= 3,3',4,4'-TETRACHLOROBIPHENYL
*SS#3= OCTACHLOROBIPHENYL
*SS#4= DECACHLOROBIPHENYL

Y= DUPLICATE
Z= SPIKED TRIPLICATE

PCB SPIKE PERCENT RECOVERY SUMMARY

SAMPLE#	LAB#	Cℓ1-PCB	Cℓ4-PCB	Cℓ8-PCB	Cℓ10-PCB
NC-ASH-01-Z	23003Z	48	82	59	75

SPIKE SOL'N.: STD#8148
(SEE PREP INFO.)

WATER SURROGATE PER.ENT RECOVERY SUMMARY

Case No. 5030.3.2 6#1+8#2 Contract Laboratory Versar, Inc. Contract No. —

	SMO TRAFFIC NO.	VOLATILE TOLUENE-D8 (88-110)	BFB (86-115)	1,2 DICHLOROETHANE-D4 (76-114)	SEMI-VOLATILE NITROBENZENE-D5 (35-114)	2-FLUOROBIPHENYL (43-116)	TERPHENYL-D14 (33-141)			PHENOL-D5 (10-94)	2-FLUOROPHENOL (21-100)	2,4,6 TRIBROMOPHENOL (10-123)	PESTICIDE DIBUTYLCHLORENDATE ** (24-154)
BC2784	RB916				91	86	89			92	87	90	NR
BC2785	EPTox BLNK				95	79	62			103 *	101 *	99	NR
BC2788	TCLP BLNK				103	92	96			87	87	85	NR
	MSTD 515		NOT REQUIRED		92	64	123			89	90	96	NR
	EPTox 22392				92	63	92			22	6 *	6 *	NR
	EPTox 23002				91	79	94			47	49	46	NR
	TCLP 22392				88	74	91			16	4 *	5 *	NR
	TCLP 23002				92	78	94			7 *	3 *	4 *	NR
KC2999	SW924RB				85	78	92			90	85	79	NR
	23002 SW924				78	60	75			74	75	74	NR

* VALUES ARE OUTSIDE OF CONTRACT REQUIRED QC LIMITS

** ADVISORY LIMITS ONLY

Volatiles: NR out of NR ; outside of QC limits

Semi-Volatiles: 9 out of 60 ; outside of QC limits

Pesticides: NR out of NR ; outside of QC limits

Comments: * Re Extractions are not required

NC-ASH = VERSAR LAB # 23002

WATER MATRIX SPIKE/MA•RIX SPIKE DUPLICATE RECOVERY

Case No. 5030.32 B#1+B#2 **Contractor** Versar, Inc. **Contract No.** —

FRACTION	COMPOUND	CONC. SPIKE ADDED (ug/L)	SAMPLE RESULT	CONC. MS	% REC	CONC. MSD	% REC	RPD	QC LIMITS* RPD	QC LIMITS* RECOVERY
VOA SMO SAMPLE NO. NR	1,1-Dichloroethene								14	61-145
	Trichloroethene								14	71-120
	Chlorobenzene								13	75-130
	Toluene								13	76-125
	Benzene								11	76-127
B/N SMO SAMPLE NO. MSTDS15	1,2,4-Trichlorobenzene	100	0	42	42				28	39-98
	Acenaphthene	↓	0	69	69				31	46-118
	2,4-Dinitrotoluene	↓	0	80	80				38	24-96
	Pyrene	↓	0	127	127				31	26-127
	N-Nitroso-Di-n-Propylamine	↓	0	89	89				38	41-116
	1,4-Dichlorobenzene	↓	0	40	40				28	36-97
ACID SMO SAMPLE NO. MSTDS15	Pentachlorophenol	200	0	173	87				50	9-103
	Phenol	↓	0	186	93				42	12-89
	2-Chlorophenol	↓	0	178	89				40	27-123
	4-Chloro-3-Methylphenol	↓	0	185	93				42	23-97
	4-Nitrophenol	↓	0	122	61				50	10-80
PEST SMO SAMPLE NO. NR	Lindane								15	56-123
	Heptachlor								20	40-131
	Aldrin								22	40-120
	Dieldrin								18	52-126
	Endrin								21	56-121
	4,4'-DDT								27	38-127

*ASTERISKED VALUES ARE OUTSIDE QC LIMITS.

RPD:
VOA: NR out of NR; outside QC limits
B/N: NA out of NA; outside QC limits
ACID: NA out of NA; outside QC limits
PEST: NR out of NR; outside QC limits

RECOVERY:
VOA: NR out of NR; outside QC limits
B/N: 0 out of 6; outside QC limits
ACID: 0 out of 5; outside QC limits
PEST: NR out of NR; outside QC limits

Comments: NR = NOT REQUIRED
NA = CAN NOT CALCULATE FROM ONE VALUE

METHOD BLANK SUMMARY

Case No. 5030-3 2 B#1.5 Region —— Contractor Versar, Inc. Contract No. —

FILE ID	DATE OF ANALYSIS	FRACTION	MATRIX	CONC. LEVEL	INST. ID	CAS NUMBER	COMPOUND NAME, TIC OR UNKNOWN	CONC.	UNITS	CRQL
BC2984 RB916	3/19/87	BNA	H_2O	Low	BC	—	No Semi Volatiles Detected	—	—	—
BO985 EPTOX BLANK	3/18/87	EPTOX	H_2O	Low	BC	—	No Semi - Volatiles Detected	—	—	—
BC2988 #662	3/19/87	TCLP	H_2O	Low	BC	—	Unknown Chlorinated Hydrocarbon	11 J	ug/L	—
TCLP BLANK #2011	↓	↓	↓	↓	↓	—	Unknown Chlorinated Hydrocarbon	5 J	↓	—
BC2999 SW924 BLANK	3/19/87	SW924	H_2O	Low	BC	—	No Semi-Volatiles Detected	—	—	—

Comments:

Versar, Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

Sample Number
EP TOX
NV ASH 01

ORGANICS ANALYSIS DATA SHEET (Page 1)

Laboratory Name: VERSAR
Lab Sample ID No: 22392
Sample Matrix: WATER
Data Release Authorized By:

Case No: 5030.3.2
QC Report No: 5030.3.2
Contract No:
Date Sample Received: 02/12/87

VOLATILE COMPOUNDS

Concentration: LOW
Date Extracted/Prepared:
Date Analyzed:
Conc/Dil Factor: 1 pH NA
Percent Moisture: 100

No volatile analysis required

CAS Number		ug/l
74-87-3	Chloromethane	10 u
74-83-9	Bromomethane	10 u
75-01-4	Vinyl Chloride	10 u
75-00-3	Chloroethane	10 u
75-09-2	Methylene Chloride	5 u
67-64-1	Acetone	10 u
75-15-0	Carbon Disulfide	5 u
75-35-4	1,1-Dichloroethene	5 u
75-34-3	1,1-Dichloroethane	5 u
156-60-5	Trans-1,2-Dichloroethene	5 u
67-66-3	Chloroform	5 u
107-06-2	1,2-Dichloroethane	5 u
78-93-3	2-butanone	10 u
71-55-6	1,1,1-Trichloroethane	5 u
56-23-5	Carbon Tetrachloride	5 u
108-05-4	Vinyl Acetate	10 u
75-27-4	Bromodichloromethane	5 u

CAS Number		ug/l
78-87-5	1,2-Dichloropropane	5 u
10061-02-6	Trans-1,3-Dichloropropene	5 u
79-01-6	Trichloroethene	5 u
124-48-1	Dibromochloromethane	5 u
79-00-5	1,1,2-Trichloroethane	5 u
71-43-2	Benzene	5 u
10061-01-5	cis-1,3-Dichloropropene	5 u
110-75-8	2-chloroethylvinylether	10 u
75-25-2	Bromoform	5 u
108-10-1	4-Methyl-2-Pentanone	10 u
591-78-6	2-Hexanone	10 u
127-18-4	Tetrachloroethene	5 u
79-34-5	1,1,2,2-Tetrachloroethane	5 u
108-88-3	Toluene	5 u
108-90-7	Chlorobenzene	5 u
100-41-4	Ethylbenzene	5 u
100-42-5	Styrene	5 u
	Total Xylenes	5 u

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

u Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response factor is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g. 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

VOAF1: REV062486

Form I

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 703/750-3000

Sample Number
EP TOX
NY ASH 01

Case No:____5030.3.2 B01 & 2_______

ORGANICS ANALYSIS DATA SHEET (Page 2)
Semivolatile Compounds

Concentration:LOW

Date Extracted/Prepared:_____________03/11/87__

Date Analyzed:____________________03/19/87__

Conc/Dil Factor:__________________1_______

GPC Cleanup [ ]Yes [ ]No

Separatory Funnel Extraction [ ]Yes

Continuous Liquid-Liquid Extraction [X]Yes

CAS Number		ug/l
108-95-2	Phenol	13 u
111-44-4	bis(2-Chloroethyl)Ether	13 u
95-57-8	2-Chlorophenol	13 u
541-73-1	1,3-Dichlorobenzene	13 u
106-46-7	1,4-Dichlorobenzene	13 u
100-51-6	Benzyl Alcohol	13 u
95-50-1	1,2-Dichlorobenzene	13 u
95-48-7	2-Methylphenol	13 u
39638-32-9	bis(2-chloroisopropyl)ether	13 u
106-44-5	4-methylphenol	13 u
621-64-7	N-Nitroso-Di-n-propylamine	13 u
67-72-1	Hexachloroethane	13 u
98-95-3	Nitrobenzene	13 u
78-59-1	Isophorone	13 u
88-75-5	2-Nitrophenol	13 u
105-67-9	2,4-dimethylphenol	13 u
65-85-0	Benzoic Acid	63u
111-91-1	bis(2-chloroethoxy)methane	13 u
120-83-2	2,4-dichlorophenol	13 u
120-82-1	1,2,4-trichlorobenzene	13 u
91-20-3	Naphthalene	13 u
106-47-8	4-Chloroaniline	13 u
87-68-3	Hexachlorobutadiene	13 u
59-50-7	4-chloro-3-methylphenol	13 u
91-57-6	2-methylnaphthalene	13 u
77-47-4	Hexachlorocyclopentadiene	13 u
88-06-2	2,4,6-Trichlorophenol	13 u
95-95-4	2,4,5-Trichlorophenol	63 u
91-58-7	2-Chloronaphthalene	13 u
88-74-4	2-Nitroaniline	63 u
131-11-3	Dimethyl Phthalate	13 u
208-96-8	Acenaphthylene	13 u
99-09-2	3-Nitroaniline	63 u

CAS Number		ug/l
83-32-9	Acenaphthene	13 u
51-28-5	2,4-Dinitrophenol	63 u
100-02-7	4-Nitrophenol	63 u
132-64-9	Dibenzofuran	13 u
121-14-2	2,4-Dinitrotoluene	13 u
606-20-2	2,6-Dinitrotoluene	13 u
84-66-2	Diethylphthalate	13 u
7005-72-3	4-Chlorophenyl-phenylether	13 u
86-73-7	Fluorene	13 u
100-01-6	4-Nitroaniline	63 u
534-52-1	4,6-dinitro-2-methylphenol	63 u
86-30-6	N-Nitrosodiphenylamine (1)	13 u
101-55-3	4-Bromophenyl-phenylether	13 u
118-74-1	Hexachlorobenzene	13 u
87-86-5	Pentachlorophenol	63 u
85-01-8	Phenanthrene	13 u
120-12-7	Anthracene	13 u
84-74-2	Di-n-butylphthalate	13 u
206-44-0	Fluoranthene	13 u
129-00-0	Pyrene	13 u
85-68-7	Butylbenzylphthalate	13 u
91-94-1	3,3'-Dichlorobenzidine	25 u
56-55-3	Benzo(a)anthracene	13 u
117-81-7	bis(2-Ethylhexyl)Phthalate	13 u
218-01-9	Chrysene	13 u
117-84-0	Di-n-Octylphthalate	13 u
205-99-2	Benzo(b)Fluoranthene	13 u
207-08-9	Benzo(k)Fluoranthene	13 u
50-32-8	Benzo(a)pyrene	13 u
193-39-5	Indeno(1,2,3-cd)Pyrene	13 u
53-70-3	Dibenz(a,h)Anthracene	13 u
191-24-2	Benzo(g,h,i)Perylene	13 u

(1)-Cannot be separated from diphenylamine

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

EP TOX

NY ASH 01

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

	CAS Number	Compound Name	Fraction	RT or [✓ Scan]	Estimated Concentration (ug/Kg or [✓ ug/l])
1.		UNKNOWN HYDROCARBON	BNA	607	21 J
2.		UNKNOWN CHLORINATED HYDROCARBON	BNA	659	16 J
3.		UNKNOWN	BNA	711	18 J
4.		UNKNOWN	BNA	826	11 J
5.	65-85-0	BENZOIC ACID	BNA	943	6 J T
6.		UNKNOWN	BNA	985	13 J
7.		UNKNOWN	BNA	1001	48 J
8.		UNKNOWN	BNA	1016	11 J
9.	60-32-2	HEXANOIC ACID, 6-AMINO-	BNA	1054	23 J
10.					
11.					
12.					
13.					
14.					
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23.					
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25.					
26.					
27.					
28.					
29.					
30.					

T- COMPOUND DOES NOT MEET CLP CRITERIA FOR COMPLETE CONFIRMATION BUT DOES INDICATE COMPOUND PRESENCE.

Versar, Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

Sample Number
EP TOX

NC 23401

ORGANICS ANALYSIS DATA SHEET (Page 1)

Laboratory Name: VERSAR
Lab Sample ID No: 23002
Sample Matrix: WATER
Data Release Authorized By:

Case No: 5030.3.2
QC Report No: 5030.3.2
Contract No:
Date Sample Received: 02/12/87

VOLATILE COMPOUNDS

Concentration: LOW
Date Extracted/Prepared:
Date Analyzed:
Conc/Dil Factor: 1 pH NA
Percent Moisture: 100

No volatile analysis required

CAS Number		ug/l
74-87-3	Chloromethane	10 u
74-83-9	Bromomethane	10 u
75-01-4	Vinyl Chloride	10 u
75-00-3	Chloroethane	10 u
75-09-2	Methylene Chloride	5 u
67-64-1	Acetone	10 u
75-15-0	Carbon Disulfide	5 u
75-35-4	1,1-Dichloroethene	5 u
75-34-3	1,1-Dichloroethane	5 u
156-60-5	Trans-1,2-Dichloroethene	5 u
67-66-3	Chloroform	5 u
107-06-2	1,2-Dichloroethane	5 u
78-93-3	2-butanone	10 u
71-55-6	1,1,1-Trichloroethane	5 u
56-23-5	Carbon Tetrachloride	5 u
108-05-4	Vinyl Acetate	10 u
75-27-4	Bromodichloromethane	5 u

CAS Number		ug/l
78-87-5	1,2-Dichloropropane	5 u
10061-02-6	Trans-1,3-Dichloropropene	5 u
79-01-6	Trichloroethene	5 u
124-48-1	Dibromochloromethane	5 u
79-00-5	1,1,2-Trichloroethane	5 u
71-43-2	Benzene	5 u
10061-01-5	cis-1,3-Dichloropropene	5 u
110-75-8	2-chloroethylvinylether	10 u
75-25-2	Bromoform	5 u
108-10-1	4-Methyl-2-Pentanone	10 u
591-78-6	2-Hexanone	10 u
127-18-4	Tetrachloroethene	5 u
79-34-5	1,1,2,2-Tetrachloroethane	5 u
108-88-3	Toluene	5 u
108-90-7	Chlorobenzene	5 u
100-41-4	Ethylbenzene	5 u
100-42-5	Styrene	5 u
	Total Xylenes	5 u

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

u Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response factor is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g. 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

VOAF1: REV062486

Form I

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 703/750-3000

|Sample Number |
|EP TOX |

NC ASH01

Case No: 5030.3.2 B01 & 2

ORGANICS ANALYSIS DATA SHEET (Page 2)
Semivolatile Compounds

Concentration: LOW

Date Extracted/Prepared: 03/11/87

Date Analyzed: 03/18/87

Conc/Dil Factor: 1

GPC Cleanup [ ]Yes [ ]No

Separatory Funnel Extraction [ ]Yes

Continuous Liquid-Liquid Extraction [X]Yes

CAS Number		ug/l
108-95-2	Phenol	13 u
111-44-4	bis(2-Chloroethyl)Ether	13 u
95-57-8	2-Chlorophenol	13 u
541-73-1	1,3-Dichlorobenzene	13 u
106-46-7	1,4-Dichlorobenzene	13 u
100-51-6	Benzyl Alcohol	13 u
95-50-1	1,2-Dichlorobenzene	13 u
95-48-7	2-Methylphenol	13 u
39638-32-9	bis(2-chloroisopropyl)ether	13 u
106-44-5	4-methylphenol	13 u
621-64-7	N-Nitroso-Di-n-propylamine	13 u
67-72-1	Hexachloroethane	13 u
98-95-3	Nitrobenzene	13 u
78-59-1	Isophorone	13 u
88-75-5	2-Nitrophenol	13 u
105-67-9	2,4-dimethylphenol	13 u
65-85-0	Benzoic Acid	66 u
111-91-1	bis(2-chloroethoxy)methane	13 u
120-83-2	2,4-dichlorophenol	13 u
120-82-1	1,2,4-trichlorobenzene	13 u
91-20-3	Naphthalene	13 u
106-47-8	4-Chloroaniline	13 u
87-68-3	Hexachlorobutadiene	13 u
59-50-7	4-chloro-3-methylphenol	13 u
91-57-6	2-methylnaphthalene	13 u
77-47-4	Hexachlorocyclopentadiene	13 u
88-06-2	2,4,6-Trichlorophenol	13 u
95-95-4	2,4,5-Trichlorophenol	66 u
91-58-7	2-Chloronaphthalene	13 u
88-74-4	2-Nitroaniline	66 u
131-11-3	Dimethyl Phthalate	13 u
208-96-8	Acenaphthylene	13 u
99-09-2	3-Nitroaniline	66 u

CAS Number		ug/l
83-32-9	Acenaphthene	13 u
51-28-5	2,4-Dinitrophenol	66 u
100-02-7	4-Nitrophenol	66 u
132-64-9	Dibenzofuran	13 u
121-14-2	2,4-Dinitrotoluene	13 u
606-20-2	2,6-Dinitrotoluene	13 u
84-66-2	Diethylphthalate	13 u
7005-72-3	4-Chlorophenyl-phenylether	13 u
86-73-7	Fluorene	13 u
100-01-6	4-Nitroaniline	66 u
534-52-1	4,6-dinitro-2-methylphenol	66 u
86-30-6	N-Nitrosodiphenylamine (1)	13 u
101-55-3	4-Bromophenyl-phenylether	13 u
118-74-1	Hexachlorobenzene	13 u
87-86-5	Pentachlorophenol	66 u
85-01-8	Phenanthrene	13 u
120-12-7	Anthracene	13 u
84-74-2	Di-n-butylphthalate	13 u
206-44-0	Fluoranthene	13 u
129-00-0	Pyrene	13 u
85-68-7	Butylbenzylphthalate	13 u
91-94-1	3,3'-Dichlorobenzidine	26 u
56-55-3	Benzo(a)anthracene	13 u
117-81-7	bis(2-Ethylhexyl)Phthalate	13 u
218-01-9	Chrysene	13 u
117-84-0	Di-n-Octylphthalate	13 u
205-99-2	Benzo(b)Fluoranthene	13 u
207-08-9	Benzo(k)Fluoranthene	13 u
50-32-8	Benzo(a)pyrene	13 u
193-39-5	Indeno(1,2,3-cd)Pyrene	13 u
53-70-3	Dibenz(a,h)Anthracene	13 u
191-24-2	Benzo(g,h,i)Perylene	13 u

(1)-Cannot be separated from diphenylamine

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

SAMPLE ID
EPTOX

NCASH01

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

	CAS Number	Compound Name	Fraction	RT or [✓ Scan]	Estimated Concentration (ug/Kg or [✓ ug/l])
1.		NO SEMIVOLATILES DETECTED	BNA	NA	NA
2.					
3.					
4.					
5.					
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7.					
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9.					
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28.					
29.					
30.					

Versar, Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

|Sample Number |
|TCLP |
~~NY ASH01~~

ORGANICS ANALYSIS DATA SHEET (Page 1)

Laboratory Name: VERSAR
Lab Sample ID No: 22392
Sample Matrix: WATER
Data Release Authorized By:

Case No: 5030.3.2
QC Report No: 5030.3.2
Contract No:
Date Sample Received: 02/12/87

VOLATILE COMPOUNDS

Concentration: LOW
Date Extracted/Prepared:
Date Analyzed:
Conc/Dil Factor: 1 pH NA
Percent Moisture: 100

No volatile analysis required

CAS Number		ug/l
74-87-3	Chloromethane	10 u
74-83-9	Bromomethane	10 u
75-01-4	Vinyl Chloride	10 u
75-00-3	Chloroethane	10 u
75-09-2	Methylene Chloride	5 u
67-64-1	Acetone	10 u
75-15-0	Carbon Disulfide	5 u
75-35-4	1,1-Dichloroethene	5 u
75-34-3	1,1-Dichloroethane	5 u
156-60-5	Trans-1,2-Dichloroethene	5 u
67-66-3	Chloroform	5 u
107-06-2	1,2-Dichloroethane	5 u
78-93-3	2-butanone	10 u
71-55-6	1,1,1-Trichloroethane	5 u
56-23-5	Carbon Tetrachloride	5 u
108-05-4	Vinyl Acetate	10 u
75-27-4	Bromodichloromethane	5 u

CAS Number		ug/l
78-87-5	1,2-Dichloropropane	5 u
10061-02-6	Trans-1,3-Dichloropropene	5 u
79-01-6	Trichloroethene	5 u
124-48-1	Dibromochloromethane	5 u
79-00-5	1,1,2-Trichloroethane	5 u
71-43-2	Benzene	5 u
10061-01-5	cis-1,3-Dichloropropene	5 u
110-75-8	2-chloroethylvinylether	10 u
75-25-2	Bromoform	5 u
108-10-1	4-Methyl-2-Pentanone	10 u
591-78-6	2-Hexanone	10 u
127-18-4	Tetrachloroethene	5 u
79-34-5	1,1,2,2-Tetrachloroethane	5 u
108-88-3	Toluene	5 u
108-90-7	Chlorobenzene	5 u
100-41-4	Ethylbenzene	5 u
100-42-5	Styrene	5 u
	Total Xylenes	5 u

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

u Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response factor is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g. 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

VOAF1: REV062486

Form I

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 703/750-3000

Sample Number
TCLP
NY ASH 01

Case No: 5030.3.2 B01 & 2

ORGANICS ANALYSIS DATA SHEET (Page 2)
Semivolatile Compounds

Concentration: LOW

Date Extracted/Prepared: 03/11/87

Date Analyzed: 03/19/87

Conc/Dil Factor: 1

GPC Cleanup ☐Yes ☐No

Separatory Funnel Extraction ☐Yes

Continuous Liquid-Liquid Extraction ☒Yes

CAS Number		ug/l
108-95-2	Phenol	14 u
111-44-4	bis(2-Chloroethyl)Ether	14 u
95-57-8	2-Chlorophenol	14 u
541-73-1	1,3-Dichlorobenzene	14 u
106-46-7	1,4-Dichlorobenzene	14 u
100-51-6	Benzyl Alcohol	14 u
95-50-1	1,2-Dichlorobenzene	14 u
95-48-7	2-Methylphenol	14 u
39638-32-9	bis(2-chloroisopropyl)ether	14 u
106-44-5	4-methylphenol	14 u
621-64-7	N-Nitroso-Di-n-propylamine	14 u
67-72-1	Hexachloroethane	14 u
98-95-3	Nitrobenzene	14 u
78-59-1	Isophorone	14 u
88-75-5	2-Nitrophenol	14 u
105-67-9	2,4-dimethylphenol	14 u
65-85-0	Benzoic Acid	68 u
111-91-1	bis(2-chloroethoxy)methane	14 u
120-83-2	2,4-dichlorophenol	14 u
120-82-1	1,2,4-trichlorobenzene	14 u
91-20-3	Naphthalene	14 u
106-47-8	4-Chloroaniline	14 u
87-68-3	Hexachlorobutadiene	14 u
59-50-7	4-chloro-3-methylphenol	14 u
91-57-6	2-methylnaphthalene	14 u
77-47-4	Hexachlorocyclopentadiene	14 u
88-06-2	2,4,6-Trichlorophenol	14 u
95-95-4	2,4,5-Trichlorophenol	68 u
91-58-7	2-Chloronaphthalene	14 u
88-74-4	2-Nitroaniline	68 u
131-11-3	Dimethyl Phthalate	14 u
208-96-8	Acenaphthylene	14 u
99-09-2	3-Nitroaniline	68 u

CAS Number		ug/l
83-32-9	Acenaphthene	14 u
51-28-5	2,4-Dinitrophenol	68 u
100-02-7	4-Nitrophenol	68 u
132-64-9	Dibenzofuran	14 u
121-14-2	2,4-Dinitrotoluene	14 u
606-20-2	2,6-Dinitrotoluene	14 u
84-66-2	Diethylphthalate	14 u
7005-72-3	4-Chlorophenyl-phenylether	14 u
86-73-7	Fluorene	14 u
100-01-6	4-Nitroaniline	68 u
534-52-1	4,6-dinitro-2-methylphenol	68 u
86-30-6	N-Nitrosodiphenylamine (1)	14 u
101-55-3	4-Bromophenyl-phenylether	14 u
118-74-1	Hexachlorobenzene	14 u
87-86-5	Pentachlorophenol	68 u
85-01-8	Phenanthrene	14 u
120-12-7	Anthracene	14 u
84-74-2	Di-n-butylphthalate	14 u
206-44-0	Fluoranthene	14 u
129-00-0	Pyrene	14 u
85-68-7	Butylbenzylphthalate	14 u
91-94-1	3,3'-Dichlorobenzidine	27 u
56-55-3	Benzo(a)anthracene	14 u
117-81-7	bis(2-Ethylhexyl)Phthalate	14 u
218-01-9	Chrysene	14 u
117-84-0	Di-n-Octylphthalate	14 u
205-99-2	Benzo(b)Fluoranthene	14 u
207-08-9	Benzo(k)Fluoranthene	14 u
50-32-8	Benzo(a)pyrene	14 u
193-39-5	Indeno(1,2,3-cd)Pyrene	14 u
53-70-3	Dibenz(a,h)Anthracene	14 u
191-24-2	Benzo(g,h,i)Perylene	14 u

(1)-Cannot be separated from diphenylamine

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

TCLP

NY ASH 01

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or [✓ Scan]	Estimated Concentration (ug/Kg or [✓ ug/l])
1.	UNKNOWN	BNA	585	16 J
2.	UNKNOWN	BNA	610	30 J
3.	UNKNOWN	BNA	616	15 J
4.	UNKNOWN	BNA	660	12 J B
5.	UNKNOWN	BNA	819	33 J
6. 65-85-0	BENZOIC ACID	BNA	939	3 J T
7.	UNKNOWN	BNA	1001	57 J
8.	UNKNOWN	BNA	1055	13 J
9.				
10.				
11.				
12.				
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28.				
29.				
30.				

T - SPECTRUM DOES NOT MEET (CLP) CRITERIA FOR COMPLETE CONFIRMATION BUT DOES INDICATE COMPOUND PRESENCE.

Versar, Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

Sample Number
TCLP
~~NC-ASH-01~~

ORGANICS ANALYSIS DATA SHEET (Page 1)

Laboratory Name: VERSAR
Lab Sample ID No: 23002
Sample Matrix: WATER
Data Release Authorized By:

Case No: 5030.3.2
QC Report No: 5030.3.2
Contract No:
Date Sample Received: 02/12/87

VOLATILE COMPOUNDS

Concentration: LOW
Date Extracted/Prepared:
Date Analyzed:
Conc/Dil Factor: 1
pH NA
Percent Moisture: 100

No volatile analysis required

CAS Number		ug/l	CAS Number		ug/l
74-87-3	Chloromethane	10 u	78-87-5	1,2-Dichloropropane	5 u
74-83-9	Bromomethane	10 u	10061-02-6	Trans-1,3-Dichloropropene	5 u
75-01-4	Vinyl Chloride	10 u	79-01-6	Trichloroethene	5 u
75-00-3	Chloroethane	10 u	124-48-1	Dibromochloromethane	5 u
75-09-2	Methylene Chloride	5 u	79-00-5	1,1,2-Trichloroethane	5 u
67-64-1	Acetone	10 u	71-43-2	Benzene	5 u
75-15-0	Carbon Disulfide	5 u	10061-01-5	cis-1,3-Dichloropropene	5 u
75-35-4	1,1-Dichloroethene	5 u	110-75-8	2-chloroethylvinylether	10 u
75-34-3	1,1-Dichloroethane	5 u	75-25-2	Bromoform	5 u
156-60-5	Trans-1,2-Dichloroethene	5 u	108-10-1	4-Methyl-2-Pentanone	10 u
67-66-3	Chloroform	5 u	591-78-6	2-Hexanone	10 u
107-06-2	1,2-Dichloroethane	5 u	127-18-4	Tetrachloroethene	5 u
78-93-3	2-butanone	10 u	79-34-5	1,1,2,2-Tetrachloroethane	5 u
71-55-6	1,1,1-Trichloroethane	5 u	108-88-3	Toluene	5 u
56-23-5	Carbon Tetrachloride	5 u	108-90-7	Chlorobenzene	5 u
108-05-4	Vinyl Acetate	10 u	100-41-4	Ethylbenzene	5 u
75-27-4	Bromodichloromethane	5 u	100-42-5	Styrene	5 u
				Total Xylenes	5 u

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

u Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response factor is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g. 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

VOAF1: REV062486

Form I

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 703/750-3000

Sample Number
TCLP

NC ASH 01

Case No: 5030.3.2 B01 & 2

ORGANICS ANALYSIS DATA SHEET (Page 2)
Semivolatile Compounds

Concentration: LOW

Date Extracted/Prepared: 03/11/87

GPC Cleanup [ ]Yes [ ]No

Date Analyzed: 03/19/87

Separatory Funnel Extraction [ ]Yes

Conc/Dil Factor: 1

Continuous Liquid-Liquid Extraction [X]Yes

CAS Number		ug/l
108-95-2	Phenol	22 u
111-44-4	bis(2-Chloroethyl)Ether	22 u
95-57-8	2-Chlorophenol	22 u
541-73-1	1,3-Dichlorobenzene	22 u
106-46-7	1,4-Dichlorobenzene	22 u
100-51-6	Benzyl Alcohol	22 u
95-50-1	1,2-Dichlorobenzene	22 u
95-48-7	2-Methylphenol	22 u
39638-32-9	bis(2-chloroisopropyl)ether	22 u
106-44-5	4-methylphenol	22 u
621-64-7	N-Nitroso-Di-n-propylamine	22 u
67-72-1	Hexachloroethane	22 u
98-95-3	Nitrobenzene	22 u
78-59-1	Isophorone	22 u
88-75-5	2-Nitrophenol	22 u
105-67-9	2,4-dimethylphenol	22 u
65-85-0	Benzoic Acid	13 J ✓
111-91-1	bis(2-chloroethoxy)methane	22 u
120-83-2	2,4-dichlorophenol	22 u
120-82-1	1,2,4-trichlorobenzene	22 u
91-20-3	Naphthalene	22 u
106-47-8	4-Chloroaniline	22 u
87-68-3	Hexachlorobutadiene	22 u
59-50-7	4-chloro-3-methylphenol	22 u
91-57-6	2-methylnaphthalene	22 u
77-47-4	Hexachlorocyclopentadiene	22 u
88-06-2	2,4,6-Trichlorophenol	22 u
95-95-4	2,4,5-Trichlorophenol	111 u
91-58-7	2-Chloronaphthalene	22 u
88-74-4	2-Nitroaniline	111 u
131-11-3	Dimethyl Phthalate	22 u
208-96-8	Acenaphthylene	22 u
99-09-2	3-Nitroaniline	111 u

CAS Number		ug/l
83-32-9	Acenaphthene	22 u
51-28-5	2,4-Dinitrophenol	111 u
100-02-7	4-Nitrophenol	111 u
132-64-9	Dibenzofuran	22 u
121-14-2	2,4-Dinitrotoluene	22 u
606-20-2	2,6-Dinitrotoluene	22 u
84-66-2	Diethylphthalate	22 u
7005-72-3	4-Chlorophenyl-phenylether	22 u
86-73-7	Fluorene	22 u
100-01-6	4-Nitroaniline	111 u
534-52-1	4,6-dinitro-2-methylphenol	111 u
86-30-6	N-Nitrosodiphenylamine (1)	22 u
101-55-3	4-Bromophenyl-phenylether	22 u
118-74-1	Hexachlorobenzene	22 u
87-86-5	Pentachlorophenol	111 u
85-01-8	Phenanthrene	22 u
120-12-7	Anthracene	22 u
84-74-2	Di-n-butylphthalate	22 u
206-44-0	Fluoranthene	22 u
129-00-0	Pyrene	22 u
85-68-7	Butylbenzylphthalate	22 u
91-94-1	3,3'-Dichlorobenzidine	44 u
56-55-3	Benzo(a)anthracene	22 u
117-81-7	bis(2-Ethylhexyl)Phthalate	22 u
218-01-9	Chrysene	22 u
117-84-0	Di-n-Octylphthalate	22 u
205-99-2	Benzo(b)Fluoranthene	22 u
207-08-9	Benzo(k)Fluoranthene	22 u
50-32-8	Benzo(a)pyrene	22 u
193-39-5	Indeno(1,2,3-cd)Pyrene	22 u
53-70-3	Dibenz(a,h)Anthracene	22 u
191-24-2	Benzo(g,h,i)Perylene	22 u

(1)-Cannot be separated from diphenylamine

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

TCLP

NC ASH 01

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or [✓ Scan]	Estimated Concentration (ug/Kg or [✓ ug/l])
1.	UNKNOWN	BNA	583	42 J
2.	UNKNOWN	BNA	615	36 J
3.	UNKNOWN	BNA	999	28 J
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Versar, Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

|Sample Number|
|SW 924|
~~NC-ASH-01~~

ORGANICS ANALYSIS DATA SHEET (Page 1)

Laboratory Name: VERSAR
Lab Sample ID No: 23002
Sample Matrix: WATER
Data Release Authorized By:

Case No: 5030.3.2
QC Report No: 5030.3.2
Contract No:
Date Sample Received: 02/12/87

VOLATILE COMPOUNDS

Concentration: LOW
Date Extracted/Prepared:
Date Analyzed:
Conc/Dil Factor: 1
pH NA
Percent Moisture: 100

No volatile analysis required

CAS Number		ug/l
74-87-3	Chloromethane	10 u
74-83-9	Bromomethane	10 u
75-01-4	Vinyl Chloride	10 u
75-00-3	Chloroethane	10 u
75-09-2	Methylene Chloride	5 u
67-64-1	Acetone	10 u
75-15-0	Carbon Disulfide	5 u
75-35-4	1,1-Dichloroethene	5 u
75-34-3	1,1-Dichloroethane	5 u
156-60-5	Trans-1,2-Dichloroethene	5 u
67-66-3	Chloroform	5 u
107-06-2	1,2-Dichloroethane	5 u
78-93-3	2-butanone	10 u
71-55-6	1,1,1-Trichloroethane	5 u
56-23-5	Carbon Tetrachloride	5 u
108-05-4	Vinyl Acetate	10 u
75-27-4	Bromodichloromethane	5 u

CAS Number		ug/l
78-87-5	1,2-Dichloropropane	5 u
10061-02-6	Trans-1,3-Dichloropropene	5 u
79-01-6	Trichloroethene	5 u
124-48-1	Dibromochloromethane	5 u
79-00-5	1,1,2-Trichloroethane	5 u
71-43-2	Benzene	5 u
10061-01-5	cis-1,3-Dichloropropene	5 u
110-75-8	2-chloroethylvinylether	10 u
75-25-2	Bromoform	5 u
108-10-1	4-Methyl-2-Pentanone	10 u
591-78-6	2-Hexanone	10 u
127-18-4	Tetrachloroethene	5 u
79-34-5	1,1,2,2-Tetrachloroethane	5 u
108-88-3	Toluene	5 u
108-90-7	Chlorobenzene	5 u
100-41-4	Ethylbenzene	5 u
100-42-5	Styrene	5 u
	Total Xylenes	5 u

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

u Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response factor is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g. 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

VOAF1: REV062486

Form I

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 703/750-3000

Sample Number
SW 924

NCASH01

Case No: 5030.3.2 B01 & 2

ORGANICS ANALYSIS DATA SHEET (Page 2)
Semivolatile Compounds

Concentration: LOW

Date Extracted/Prepared: 03/11/87

Date Analyzed: 03/19/87

Conc/Dil Factor: 1

GPC Cleanup ☐ Yes ☐ No

Separatory Funnel Extraction ☐ Yes

Continuous Liquid-Liquid Extraction ☒ Yes

CAS Number		ug/l
108-95-2	Phenol	11 u
111-44-4	bis(2-Chloroethyl)Ether	11 u
95-57-8	2-Chlorophenol	11 u
541-73-1	1,3-Dichlorobenzene	11 u
106-46-7	1,4-Dichlorobenzene	11 u
100-51-6	Benzyl Alcohol	11 u
95-50-1	1,2-Dichlorobenzene	11 u
95-48-7	2-Methylphenol	11 u
39638-32-9	bis(2-chloroisopropyl)ether	11 u
106-44-5	4-methylphenol	11 u
621-64-7	N-Nitroso-Di-n-propylamine	11 u
67-72-1	Hexachloroethane	11 u
98-95-3	Nitrobenzene	11 u
78-59-1	Isophorone	11 u
88-75-5	2-Nitrophenol	11 u
105-67-9	2,4-dimethylphenol	11 u
65-85-0	Benzoic Acid	53u
111-91-1	bis(2-chloroethoxy)methane	11 u
120-83-2	2,4-dichlorophenol	11 u
120-82-1	1,2,4-trichlorobenzene	11 u
91-20-3	Naphthalene	11 u
106-47-8	4-Chloroaniline	11 u
87-68-3	Hexachlorobutadiene	11 u
59-50-7	4-chloro-3-methylphenol	11 u
91-57-6	2-methylnaphthalene	11 u
77-47-4	Hexachlorocyclopentadiene	11 u
88-06-2	2,4,6-Trichlorophenol	11 u
95-95-4	2,4,5-Trichlorophenol	53 u
91-58-7	2-Chloronaphthalene	11 u
88-74-4	2-Nitroaniline	53 u
131-11-3	Dimethyl Phthalate	11 u
208-96-8	Acenaphthylene	11 u
99-09-2	3-Nitroaniline	53 u

CAS Number		ug/l
83-32-9	Acenaphthene	11 u
51-28-5	2,4-Dinitrophenol	53 u
100-02-7	4-Nitrophenol	53 u
132-64-9	Dibenzofuran	11 u
121-14-2	2,4-Dinitrotoluene	11 u
606-20-2	2,6-Dinitrotoluene	11 u
84-66-2	Diethylphthalate	11 u
7005-72-3	4-Chlorophenyl-phenylether	11 u
86-73-7	Fluorene	11 u
100-01-6	4-Nitroaniline	53 u
534-52-1	4,6-dinitro-2-methylphenol	53 u
86-30-6	N-Nitrosodiphenylamine (1)	11 u
101-55-3	4-Bromophenyl-phenylether	11 u
118-74-1	Hexachlorobenzene	11 u
87-86-5	Pentachlorophenol	53 u
85-01-8	Phenanthrene	11 u
120-12-7	Anthracene	11 u
84-74-2	Di-n-butylphthalate	11 u
206-44-0	Fluoranthene	11 u
129-00-0	Pyrene	11 u
85-68-7	Butylbenzylphthalate	11 u
91-94-1	3,3'-Dichlorobenzidine	21 u
56-55-3	Benzo(a)anthracene	11 u
117-81-7	bis(2-Ethylhexyl)Phthalate	11 u
218-01-9	Chrysene	11 u
117-84-0	Di-n-Octylphthalate	11 u
205-99-2	Benzo(b)Fluoranthene	11 u
207-08-9	Benzo(k)Fluoranthene	11 u
50-32-8	Benzo(a)pyrene	11 u
193-39-5	Indeno(1,2,3-cd)Pyrene	11 u
53-70-3	Dibenz(a,h)Anthracene	11 u
191-24-2	Benzo(g,h,i)Perylene	11 u

(1)-Cannot be separated from diphenylamine

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

SW 924

NC ASH 01

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

	CAS Number	Compound Name	Fraction	RT or [✓ Scan]	Estimated Concentration (ug/Kg or [✓ ug/l])
1.		UNKNOWN ORGANIC ACID	BNA	569	6 J
2.		UNKNOWN	BNA	607	33 J
3.	142-62-1	HEXANOIC ACID	BNA	709	14 J
4.	766-39-2	2,5-FURANDIONE, 3,4-DIMETHYL-	BNA	783	9 J
5.		UNKNOWN	BNA	815	9 J
6.	65-85-0	BENZOIC ACID	BNA	944	7 J.T.
7.		UNKNOWN	BNA	999	10 J
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T - SPECTRUM DOES NOT COMPLETELY MEET (CLP) CRITERIA FOR CONFIRMATION, BUT DOES INDICATE COMPOUND PRESENCE.

Versar, Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

Sample Number
RB916/BC2984

ORGANICS ANALYSIS DATA SHEET (Page 1)

Laboratory Name: VERSAR
Lab Sample ID No: BC2984
Sample Matrix: WATER
Data Release Authorized By:

Case No: 5030.3.2
QC Report No: 5030.3.2
Contract No:
Date Sample Received:

LAB Gen [illegible]

VOLATILE COMPOUNDS

Concentration: LOW
Date Extracted/Prepared:
Date Analyzed:
Conc/Dil Factor: 1 pH NA
Percent Moisture: 100

No volatile analysis required

CAS Number		ug/l	CAS Number		ug/l
74-87-3	Chloromethane	10 u	78-87-5	1,2-Dichloropropane	5 u
74-83-9	Bromomethane	10 u	10061-02-6	Trans-1,3-Dichloropropene	5 u
75-01-4	Vinyl Chloride	10 u	79-01-6	Trichloroethene	5 u
75-00-3	Chloroethane	10 u	124-48-1	Dibromochloromethane	5 u
75-09-2	Methylene Chloride	5 u	79-00-5	1,1,2-Trichloroethane	5 u
67-64-1	Acetone	10 u	71-43-2	Benzene	5 u
75-15-0	Carbon Disulfide	5 u	10061-01-5	cis-1,3-Dichloropropene	5 u
75-35-4	1,1-Dichloroethene	5 u	110-75-8	2-chloroethylvinylether	10 u
75-34-3	1,1-Dichloroethane	5 u	75-25-2	Bromoform	5 u
156-60-5	Trans-1,2-Dichloroethene	5 u	108-10-1	4-Methyl-2-Pentanone	10 u
67-66-3	Chloroform	5 u	591-78-6	2-Hexanone	10 u
107-06-2	1,2-Dichloroethane	5 u	127-18-4	Tetrachloroethene	5 u
78-93-3	2-butanone	10 u	79-34-5	1,1,2,2-Tetrachloroethane	5 u
71-55-6	1,1,1-Trichloroethane	5 u	108-88-3	Toluene	5 u
56-23-5	Carbon Tetrachloride	5 u	108-90-7	Chlorobenzene	5 u
108-05-4	Vinyl Acetate	10 u	100-41-4	Ethylbenzene	5 u
75-27-4	Bromodichloromethane	5 u	100-42-5	Styrene	5 u
				Total Xylenes	5 u

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

u Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response factor is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g. 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

VOAF1: REV062486

Form I

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 703/750-3000

Sample Number
RB916/BC2984

Case No: 5030.3.2 B01 & 2

ORGANICS ANALYSIS DATA SHEET (Page 2)
Semivolatile Compounds

Concentration:LOW

Date Extracted/Prepared: 03/11/87

Date Analyzed: 03/18/87

Conc/Dil Factor: 1

GPC Cleanup [ ]Yes [ ]No

Separatory Funnel Extraction [ ]Yes

Continuous Liquid-Liquid Extraction [X]Yes

CAS Number		ug/l
108-95-2	Phenol	10 u
111-44-4	bis(2-Chloroethyl)Ether	10 u
95-57-8	2-Chlorophenol	10 u
541-73-1	1,3-Dichlorobenzene	10 u
106-46-7	1,4-Dichlorobenzene	10 u
100-51-6	Benzyl Alcohol	10 u
95-50-1	1,2-Dichlorobenzene	10 u
95-48-7	2-Methylphenol	10 u
39638-32-9	bis(2-chloroisopropyl)ether	10 u
106-44-5	4-methylphenol	10 u
621-64-7	N-Nitroso-Di-n-propylamine	10 u
67-72-1	Hexachloroethane	10 u
98-95-3	Nitrobenzene	10 u
78-59-1	Isophorone	10 u
88-75-5	2-Nitrophenol	10 u
105-67-9	2,4-dimethylphenol	10 u
65-85-0	Benzoic Acid	50 u
111-91-1	bis(2-chloroethoxy)methane	10 u
120-83-2	2,4-dichlorophenol	10 u
120-82-1	1,2,4-trichlorobenzene	10 u
91-20-3	Naphthalene	10 u
106-47-8	4-Chloroaniline	10 u
87-68-3	Hexachlorobutadiene	10 u
59-50-7	4-chloro-3-methylphenol	10 u
91-57-6	2-methylnaphthalene	10 u
77-47-4	Hexachlorocyclopentadiene	10 u
88-06-2	2,4,6-Trichlorophenol	10 u
95-95-4	2,4,5-Trichlorophenol	50 u
91-58-7	2-Chloronaphthalene	10 u
88-74-4	2-Nitroaniline	50 u
131-11-3	Dimethyl Phthalate	10 u
208-96-8	Acenaphthylene	10 u
99-09-2	3-Nitroaniline	50 u

CAS Number		ug/l
83-32-9	Acenaphthene	10 u
51-28-5	2,4-Dinitrophenol	50 u
100-02-7	4-Nitrophenol	50 u
132-64-9	Dibenzofuran	10 u
121-14-2	2,4-Dinitrotoluene	10 u
606-20-2	2,6-Dinitrotoluene	10 u
84-66-2	Diethylphthalate	10 u
7005-22-3	4-Chlorophenyl-phenylether	10 u
86-73-7	Fluorene	10 u
100-01-6	4-Nitroaniline	50 u
534-52-1	4,6-dinitro-2-methylphenol	50 u
86-30-6	N-Nitrosodiphenylamine (1)	10 u
101-55-3	4-Bromophenyl-phenylether	10 u
118-74-1	Hexachlorobenzene	10 u
87-86-5	Pentachlorophenol	50 u
85-01-8	Phenanthrene	10 u
120-12-7	Anthracene	10 u
84-74-2	Di-n-butylphthalate	10 u
206-44-0	Fluoranthene	10 u
129-00-0	Pyrene	10 u
85-68-7	Butylbenzylphthalate	10 u
91-94-1	3,3'-Dichlorobenzidine	20 u
56-55-3	Benzo(a)anthracene	10 u
117-81-7	bis(2-Ethylhexyl)Phthalate	10 u
218-01-9	Chrysene	10 u
117-84-0	Di-n-Octylphthalate	10 u
205-99-2	Benzo(b)Fluoranthene	10 u
207-08-9	Benzo(k)Fluoranthene	10 u
50-32-8	Benzo(a)pyrene	10 u
193-39-5	Indeno(1,2,3-cd)Pyrene	10 u
53-70-3	Dibenz(a,h)Anthracene	10 u
191-24-2	Benzo(g,h,i)Perylene	10 u

(1)-Cannot be separated from diphenylamine

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

SAMPLE ID
RB916/BC2984

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or [✓ Scan]	Estimated Concentration (ug/Kg or [✓ ug/l])
1.	NO SEMIVOLATILES DETECTED	BNA	NA	NA
2.				
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Versar, Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

Sample Number
EP TOX BLANK

ORGANICS ANALYSIS DATA SHEET (Page 1)

Laboratory Name: VERSAR
Lab Sample ID No: BC2985
Sample Matrix: WATER
Data Release Authorized By:
Case No: 5030.3.2
QC Report No: 5030.3.2
Contract No:
Date Sample Received:

LAB GENERATED

VOLATILE COMPOUNDS

Concentration: LOW
Date Extracted/Prepared:
Date Analyzed:
Conc/Dil Factor: 1 pH NA
Percent Moisture: 100

No volatile analysis required

CAS Number		ug/l	CAS Number		ug/l
74-87-3	Chloromethane	10 u	78-87-5	1,2-Dichloropropane	5 u
74-83-9	Bromomethane	10 u	10061-02-6	Trans-1,3-Dichloropropene	5 u
75-01-4	Vinyl Chloride	10 u	79-01-6	Trichloroethene	5 u
75-00-3	Chloroethane	10 u	124-48-1	Dibromochloromethane	5 u
75-09-2	Methylene Chloride	5 u	79-00-5	1,1,2-Trichloroethane	5 u
67-64-1	Acetone	10 u	71-43-2	Benzene	5 u
75-15-0	Carbon Disulfide	5 u	10061-01-5	cis-1,3-Dichloropropene	5 u
75-35-4	1,1-Dichloroethene	5 u	110-75-8	2-chloroethylvinylether	10 u
75-34-3	1,1-Dichloroethane	5 u	75-25-2	Bromoform	5 u
156-60-5	Trans-1,2-Dichloroethene	5 u	108-10-1	4-Methyl-2-Pentanone	10 u
67-66-3	Chloroform	5 u	591-78-6	2-Hexanone	10 u
107-06-2	1,2-Dichloroethane	5 u	127-18-4	Tetrachloroethene	5 u
78-93-3	2-butanone	10 u	79-34-5	1,1,2,2-Tetrachloroethane	5 u
71-55-6	1,1,1-Trichloroethane	5 u	108-88-3	Toluene	5 u
56-23-5	Carbon Tetrachloride	5 u	108-90-7	Chlorobenzene	5 u
108-05-4	Vinyl Acetate	10 u	100-41-4	Ethylbenzene	5 u
75-27-4	Bromodichloromethane	5 u	100-42-5	Styrene	5 u
				Total Xylenes	5 u

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

u Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response factor is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g. 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

VOAF1: REV062486

Form I

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 703/750-3000

|Sample Number |
|EP TOX BLANK |

BC2985

Case No:____5030.3.2 B01 & 2_______

ORGANICS ANALYSIS DATA SHEET (Page 2)
Semivolatile Compounds

Concentration:LOW

Date Extracted/Prepared:______________03/11/87__

GPC Cleanup [ ]Yes [ ]No

Date Analyzed:_________________________03/18/87__

Separatory Funnel Extraction [ ]Yes

Conc/Dil Factor:______________________1_______

Continuous Liquid-Liquid Extraction [X]Yes

CAS Number		ug/l
108-95-2	Phenol	10 u
111-44-4	bis(2-Chloroethyl)Ether	10 u
95-57-8	2-Chlorophenol	10 u
541-73-1	1,3-Dichlorobenzene	10 u
106-46-7	1,4-Dichlorobenzene	10 u
100-51-6	Benzyl Alcohol	10 u
95-50-1	1,2-Dichlorobenzene	10 u
95-48-7	2-Methylphenol	10 u
39638-32-9	bis(2-chloroisopropyl)ether	10 u
106-44-5	4-methylphenol	10 u
621-64-7	N-Nitroso-Di-n-propylamine	10 u
67-72-1	Hexachloroethane	10 u
98-95-3	Nitrobenzene	10 u
78-59-1	Isophorone	10 u
88-75-5	2-Nitrophenol	10 u
105-67-9	2,4-dimethylphenol	10 u
65-85-0	Benzoic Acid	50 u
111-91-1	bis(2-chloroethoxy)methane	10 u
120-83-2	2,4-dichlorophenol	10 u
120-82-1	1,2,4-trichlorobenzene	10 u
91-20-3	Naphthalene	10 u
106-47-8	4-Chloroaniline	10 u
87-68-3	Hexachlorobutadiene	10 u
59-50-7	4-chloro-3-methylphenol	10 u
91-57-6	2-methylnaphthalene	10 u
77-47-4	Hexachlorocyclopentadiene	10 u
88-06-2	2,4,6-Trichlorophenol	10 u
95-95-4	2,4,5-Trichlorophenol	50 u
91-58-7	2-Chloronaphthalene	10 u
88-74-4	2-Nitroaniline	50 u
131-11-3	Dimethyl Phthalate	10 u
208-96-8	Acenaphthylene	10 u
99-09-2	3-Nitroaniline	50 u

CAS Number		ug/l
83-32-9	Acenaphthene	10 u
51-28-5	2,4-Dinitrophenol	50 u
100-02-7	4-Nitrophenol	50 u
132-64-9	Dibenzofuran	10 u
121-14-2	2,4-Dinitrotoluene	10 u
606-20-2	2,6-Dinitrotoluene	10 u
84-66-2	Diethylphthalate	10 u
7005-22-3	4-Chlorophenyl-phenylether	10 u
86-73-7	Fluorene	10 u
100-01-6	4-Nitroaniline	50 u
534-52-1	4,6-dinitro-2-methylphenol	50 u
86-30-6	N-Nitrosodiphenylamine (1)	10 u
101-55-3	4-Bromophenyl-phenylether	10 u
118-74-1	Hexachlorobenzene	10 u
87-86-5	Pentachlorophenol	50 u
85-01-8	Phenanthrene	10 u
120-12-7	Anthracene	10 u
84-74-2	Di-n-butylphthalate	10 u
206-44-0	Fluoranthene	10 u
129-00-0	Pyrene	10 u
85-68-7	Butylbenzylphthalate	10 u
91-94-1	3,3'-Dichlorobenzidine	20 u
56-55-3	Benzo(a)anthracene	10 u
117-81-7	bis(2-Ethylhexyl)Phthalate	10 u
218-01-9	Chrysene	10 u
117-84-0	Di-n-Octylphthalate	10 u
205-99-2	Benzo(b)Fluoranthene	10 u
207-08-9	Benzo(k)Fluoranthene	10 u
50-32-8	Benzo(a)pyrene	10 u
193-39-5	Indeno(1,2,3-cd)Pyrene	10 u
53-70-3	Dibenz(a,h)Anthracene	10 u
191-24-2	Benzo(g,h,i)Perylene	10 u

(1)-Cannot be separated from diphenylamine

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

SAMPLE ID
EP TOX BLANK

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or [✓ Scan]	Estimated Concentration (ug/Kg or [✓ ug/l])
1.	NO SEMIVOLATILES DETECTED	BNA	NA	NA
2.				
3.				
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Versar, Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

Sample Number
TCLP BLNK

ORGANICS ANALYSIS DATA SHEET (Page 1)

Laboratory Name: VERSAR
Lab Sample ID No: BC2988
Sample Matrix: WATER
Data Release Authorized By:

Case No: 5030.3.2
QC Report No: 5030.3.2
Contract No:
Date Sample Received:

LAB GENERATED

VOLATILE COMPOUNDS

Concentration: LOW
Date Extracted/Prepared:
Date Analyzed:
Conc/Dil Factor: 1 pH NA
Percent Moisture: 100

No volatile analysis required

CAS Number		ug/l	CAS Number		ug/l
74-87-3	Chloromethane	10 u	78-87-5	1,2-Dichloropropane	5 u
74-83-9	Bromomethane	10 u	10061-02-6	Trans-1,3-Dichloropropene	5 u
75-01-4	Vinyl Chloride	10 u	79-01-6	Trichloroethene	5 u
75-00-3	Chloroethane	10 u	124-48-1	Dibromochloromethane	5 u
75-09-2	Methylene Chloride	5 u	79-00-5	1,1,2-Trichloroethane	5 u
67-64-1	Acetone	10 u	71-43-2	Benzene	5 u
75-15-0	Carbon Disulfide	5 u	10061-01-5	cis-1,3-Dichloropropene	5 u
75-35-4	1,1-Dichloroethene	5 u	110-75-8	2-chloroethylvinylether	10 u
75-34-3	1,1-Dichloroethane	5 u	75-25-2	Bromoform	5 u
156-60-5	Trans-1,2-Dichloroethene	5 u	108-10-1	4-Methyl-2-Pentanone	10 u
67-66-3	Chloroform	5 u	591-78-6	2-Hexanone	10 u
107-06-2	1,2-Dichloroethane	5 u	127-18-4	Tetrachloroethene	5 u
78-93-3	2-butanone	10 u	79-34-5	1,1,2,2-Tetrachloroethane	5 u
71-55-6	1,1,1-Trichloroethane	5 u	108-88-3	Toluene	5 u
56-23-5	Carbon Tetrachloride	5 u	108-90-7	Chlorobenzene	5 u
108-05-4	Vinyl Acetate	10 u	100-41-4	Ethylbenzene	5 u
75-27-4	Bromodichloromethane	5 u	100-42-5	Styrene	5 u
				Total Xylenes	5 u

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

u Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response factor is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g. 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

VOAF1: REV062486

Form I

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 703/750-3000

Sample Number
TCLP BLNK

BC2988

Case No: 5030.3.2 B01 & 2

ORGANICS ANALYSIS DATA SHEET (Page 2)
Semivolatile Compounds

Concentration:LOW

Date Extracted/Prepared: 03/11/87

Date Analyzed: 03/19/87

Conc/Dil Factor: 1

GPC Cleanup [ ]Yes [X]No

Separatory Funnel Extraction [ ]Yes

Continuous Liquid-Liquid Extraction [X]Yes

CAS Number		ug/l
108-95-2	Phenol	11 u
111-44-4	bis(2-Chloroethyl)Ether	11 u
95-57-8	2-Chlorophenol	11 u
541-73-1	1,3-Dichlorobenzene	11 u
106-46-7	1,4-Dichlorobenzene	11 u
100-51-6	Benzyl Alcohol	11 u
95-50-1	1,2-Dichlorobenzene	11 u
95-48-7	2-Methylphenol	11 u
39638-32-9	bis(2-chloroisopropyl)ether	11 u
106-44-5	4-methylphenol	11 u
621-64-7	N-Nitroso-Di-n-propylamine	11 u
67-72-1	Hexachloroethane	11 u
98-95-3	Nitrobenzene	11 u
78-59-1	Isophorone	11 u
88-75-5	2-Nitrophenol	11 u
105-67-9	2,4-dimethylphenol	11 u
65-85-0	Benzoic Acid	56 u
111-91-1	bis(2-chloroethoxy)methane	11 u
120-83-2	2,4-dichlorophenol	11 u
120-82-1	1,2,4-trichlorobenzene	11 u
91-20-3	Naphthalene	11 u
106-47-8	4-Chloroaniline	11 u
87-68-3	Hexachlorobutadiene	11 u
59-50-7	4-chloro-3-methylphenol	11 u
91-57-6	2-methylnaphthalene	11 u
77-47-4	Hexachlorocyclopentadiene	11 u
88-06-2	2,4,6-Trichlorophenol	11 u
95-95-4	2,4,5-Trichlorophenol	56 u
91-58-7	2-Chloronaphthalene	11 u
88-74-4	2-Nitroaniline	56 u
131-11-3	Dimethyl Phthalate	11 u
208-96-8	Acenaphthylene	11 u
99-09-2	3-Nitroaniline	56 u

CAS Number		ug/l
83-32-9	Acenaphthene	11 u
51-28-5	2,4-Dinitrophenol	56 u
100-02-7	4-Nitrophenol	56 u
132-64-9	Dibenzofuran	11 u
121-14-2	2,4-Dinitrotoluene	11 u
606-20-2	2,6-Dinitrotoluene	11 u
84-66-2	Diethylphthalate	11 u
7005-72-3	4-Chlorophenyl-phenylether	11 u
86-73-7	Fluorene	11 u
100-01-6	4-Nitroaniline	56 u
534-52-1	4,6-dinitro-2-methylphenol	56 u
86-30-6	N-Nitrosodiphenylamine (1)	11 u
101-55-3	4-Bromophenyl-phenylether	11 u
118-74-1	Hexachlorobenzene	11 u
87-86-5	Pentachlorophenol	56 u
85-01-8	Phenanthrene	11 u
120-12-7	Anthracene	11 u
84-74-2	Di-n-butylphthalate	11 u
206-44-0	Fluoranthene	11 u
129-00-0	Pyrene	11 u
85-68-7	Butylbenzylphthalate	11 u
91-94-1	3,3'-Dichlorobenzidine	22 u
56-55-3	Benzo(a)anthracene	11 u
117-81-7	bis(2-Ethylhexyl)Phthalate	11 u
218-01-9	Chrysene	11 u
117-84-0	Di-n-Octylphthalate	11 u
205-99-2	Benzo(b)Fluoranthene	11 u
207-08-9	Benzo(k)Fluoranthene	11 u
50-32-8	Benzo(a)pyrene	11 u
193-39-5	Indeno(1,2,3-cd)Pyrene	11 u
53-70-3	Dibenz(a,h)Anthracene	11 u
191-24-2	Benzo(g,h,i)Perylene	11 u

(1)-Cannot be separated from diphenylamine

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

TCLP BLNK

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or [✓ Scan]	Estimated Concentration (ug/Kg or [✓ ug/l])
1.	UNKNOWN CHLORINATED HYDROCARBON	BNA	662	11 J
2.	UNKNOWN CHLORINATED HYDROCARBON	BNA	2011	5 J
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Versar, Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

Sample Number
SW 924 BLANK

ORGANICS ANALYSIS DATA SHEET (Page 1)

Laboratory Name: VERSAR
Lab Sample ID No: BC2999
Sample Matrix: WATER
Data Release Authorized By:

Case No: 5030.3.2
QC Report No: 5030.3.2
Contract No:
Date Sample Received:

LAB GENERATED

VOLATILE COMPOUNDS

Concentration: LOW
Date Extracted/Prepared:
Date Analyzed:
Conc/Dil Factor: 1 pH NA
Percent Moisture: 100

No volatile analysis required

CAS Number		ug/l	CAS Number		ug/l
74-87-3	Chloromethane	10 u	78-87-5	1,2-Dichloropropane	5 u
74-83-9	Bromomethane	10 u	10061-02-6	Trans-1,3-Dichloropropene	5 u
75-01-4	Vinyl Chloride	10 u	79-01-6	Trichloroethene	5 u
75-00-3	Chloroethane	10 u	124-48-1	Dibromochloromethane	5 u
75-09-2	Methylene Chloride	5 u	79-00-5	1,1,2-Trichloroethane	5 u
67-64-1	Acetone	10 u	71-43-2	Benzene	5 u
75-15-0	Carbon Disulfide	5 u	10061-01-5	cis-1,3-Dichloropropene	5 u
75-35-4	1,1-Dichloroethene	5 u	110-75-8	2-chloroethylvinylether	10 u
75-34-3	1,1-Dichloroethane	5 u	75-25-2	Bromoform	5 u
156-60-5	Trans-1,2-Dichloroethene	5 u	108-10-1	4-Methyl-2-Pentanone	10 u
67-66-3	Chloroform	5 u	591-78-6	2-Hexanone	10 u
107-06-2	1,2-Dichloroethane	5 u	127-18-4	Tetrachloroethene	5 u
78-93-3	2-butanone	10 u	79-34-5	1,1,2,2-Tetrachloroethane	5 u
71-55-6	1,1,1-Trichloroethane	5 u	108-88-3	Toluene	5 u
56-23-5	Carbon Tetrachloride	5 u	108-90-7	Chlorobenzene	5 u
108-05-4	Vinyl Acetate	10 u	100-41-4	Ethylbenzene	5 u
75-27-4	Bromodichloromethane	5 u	100-42-5	Styrene	5 u
				Total Xylenes	5 u

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

u Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response factor is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g. 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

VOAF1: REV062486

Form I

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 703/750-3000

Sample Number
SW 924 BLANK

BC2999

Case No: 5030.3.2 B01 & 2

ORGANICS ANALYSIS DATA SHEET (Page 2)
Semivolatile Compounds

Concentration:LOW

Date Extracted/Prepared: 03/11/87

Date Analyzed: 03/19/87

Conc/Dil Factor: 1

GPC Cleanup [ ]Yes [ ]No

Separatory Funnel Extraction [ ]Yes

Continuous Liquid-Liquid Extraction [X]Yes

CAS Number		ug/l
108-95-2	Phenol	10 u
111-44-4	bis(2-Chloroethyl)Ether	10 u
95-57-8	2-Chlorophenol	10 u
541-73-1	1,3-Dichlorobenzene	10 u
106-46-7	1,4-Dichlorobenzene	10 u
100-51-6	Benzyl Alcohol	10 u
95-50-1	1,2-Dichlorobenzene	10 u
95-48-7	2-Methylphenol	10 u
39638-32-9	bis(2-chloroisopropyl)ether	10 u
106-44-5	4-methylphenol	10 u
621-64-7	N-Nitroso-Di-n-propylamine	10 u
67-72-1	Hexachloroethane	10 u
98-95-3	Nitrobenzene	10 u
78-59-1	Isophorone	10 u
88-75-5	2-Nitrophenol	10 u
105-67-9	2,4-dimethylphenol	10 u
65-85-0	Benzoic Acid	50 u
111-91-1	bis(2-chloroethoxy)methane	10 u
120-83-2	2,4-dichlorophenol	10 u
120-82-1	1,2,4-trichlorobenzene	10 u
91-20-3	Naphthalene	10 u
106-47-8	4-Chloroaniline	10 u
87-68-3	Hexachlorobutadiene	10 u
59-50-7	4-chloro-3-methylphenol	10 u
91-57-6	2-methylnaphthalene	10 u
77-47-4	Hexachlorocyclopentadiene	10 u
88-06-2	2,4,6-Trichlorophenol	10 u
95-95-4	2,4,5-Trichlorophenol	50 u
91-58-7	2-Chloronaphthalene	10 u
88-74-4	2-Nitroaniline	50 u
131-11-3	Dimethyl Phthalate	10 u
208-96-8	Acenaphthylene	10 u
99-09-2	3-Nitroaniline	50 u

CAS Number		ug/l
83-32-9	Acenaphthene	10 u
51-28-5	2,4-Dinitrophenol	50 u
100-02-7	4-Nitrophenol	50 u
132-64-9	Dibenzofuran	10 u
121-14-2	2,4-Dinitrotoluene	10 u
606-20-2	2,6-Dinitrotoluene	10 u
84-66-2	Diethylphthalate	10 u
7005-72-3	4-Chlorophenyl-phenylether	10 u
86-73-7	Fluorene	10 u
100-01-6	4-Nitroaniline	50 u
534-52-1	4,6-dinitro-2-methylphenol	50 u
86-30-6	N-Nitrosodiphenylamine (1)	10 u
101-55-3	4-Bromophenyl-phenylether	10 u
118-74-1	Hexachlorobenzene	10 u
87-86-5	Pentachlorophenol	50 u
85-01-8	Phenanthrene	10 u
120-12-7	Anthracene	10 u
84-74-2	Di-n-butylphthalate	10 u
206-44-0	Fluoranthene	10 u
129-00-0	Pyrene	10 u
85-68-7	Butylbenzylphthalate	10 u
91-94-1	3,3'-Dichlorobenzidine	20 u
56-55-3	Benzo(a)anthracene	10 u
117-81-7	bis(2-Ethylhexyl)Phthalate	10 u
218-01-9	Chrysene	10 u
117-84-0	Di-n-Octylphthalate	10 u
205-99-2	Benzo(b)Fluoranthene	10 u
207-08-9	Benzo(k)Fluoranthene	10 u
50-32-8	Benzo(a)pyrene	10 u
193-39-5	Indeno(1,2,3-cd)Pyrene	10 u
53-70-3	Dibenz(a,h)Anthracene	10 u
191-24-2	Benzo(g,h,i)Perylene	10 u

(1)-Cannot be separated from diphenylamine

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

SAMPLE ID
SW924BLANK

Organics Analysis Data Sheet
(Page 4)

Tentatively Identified Compounds

CAS Number	Compound Name	Fraction	RT or [✓ Scan]	Estimated Concentration (ug/Kg or [✓ ug/l])
1.	NO SEMIVOLATILES DETECTED	BNA	NA	NA
2.				
3.				
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Versar, Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 (703) 750-3000

Sample Number
MSTD 515

ORGANICS ANALYSIS DATA SHEET (Page 1)

Laboratory Name: VERSAR
Lab Sample ID No: BC2991
Sample Matrix: WATER
Data Release Authorized By:

Case No: 5030.3.2
QC Report No: 5030.3.2
Contract No:
Date Sample Received:

UNCONSOLIDATED

VOLATILE COMPOUNDS

Concentration: LOW
Date Extracted/Prepared:
Date Analyzed:
Conc/Dil Factor: 1
pH NA
Percent Moisture: 100

No volatile analysis required

CAS Number		ug/l	CAS Number		ug/l
74-87-3	Chloromethane	10 u	78-87-5	1,2-Dichloropropane	5 u
74-83-9	Bromomethane	10 u	10061-02-6	Trans-1,3-Dichloropropene	5 u
75-01-4	Vinyl Chloride	10 u	79-01-6	Trichloroethene	5 u
75-00-3	Chloroethane	10 u	124-48-1	Dibromochloromethane	5 u
75-09-2	Methylene Chloride	5 u	79-00-5	1,1,2-Trichloroethane	5 u
67-64-1	Acetone	10 u	71-43-2	Benzene	5 u
75-15-0	Carbon Disulfide	5 u	10061-01-5	cis-1,3-Dichloropropene	5 u
75-35-4	1,1-Dichloroethene	5 u	110-75-8	2-chloroethylvinylether	10 u
75-34-3	1,1-Dichloroethane	5 u	75-25-2	Bromoform	5 u
156-60-5	Trans-1,2-Dichloroethene	5 u	108-10-1	4-Methyl-2-Pentanone	10 u
67-66-3	Chloroform	5 u	591-78-6	2-Hexanone	10 u
107-06-2	1,2-Dichloroethane	5 u	127-18-4	Tetrachloroethene	5 u
78-93-3	2-butanone	10 u	79-34-5	1,1,2,2-Tetrachloroethane	5 u
71-55-6	1,1,1-Trichloroethane	5 u	108-88-3	Toluene	5 u
56-23-5	Carbon Tetrachloride	5 u	108-90-7	Chlorobenzene	5 u
108-05-4	Vinyl Acetate	10 u	100-41-4	Ethylbenzene	5 u
75-27-4	Bromodichloromethane	5 u	100-42-5	Styrene	5 u
				Total Xylenes	5 u

Data Reporting Qualifiers

Value If the result is a value greater than or equal to the detection limit, report the value.

u Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.

J Estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response factor is assumed, or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. (e.g. 10J)

C This flag applies to pesticide parameters where the identification has been confirmed by GC/MS.

B This flag is used when the analyte is found in the blank as well as the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

VOAF1: REV062486

Form I

Versar Inc., Laboratory Operations
6850 Versar Center, Springfield VA 22151 703/750-3000

Sample Number
MGTD 515

Case No:____5030.3.2 B01 & 2_______

ORGANICS ANALYSIS DATA SHEET (Page 2)
Semivolatile Compounds

Concentration:LOW

Date Extracted/Prepared:______________03/11/87_

Date Analyzed:_______________________03/19/87_

Conc/Dil Factor:_____________________1_______

GPC Cleanup ☐ Yes ☐ No

Separatory Funnel Extraction ☐ Yes

Continuous Liquid-Liquid Extraction ☒ Yes

CAS Number		ug/l
108-95-2	Phenol	10 u
111-44-4	bis(2-Chloroethyl)Ether	10 u
95-57-8	2-Chlorophenol	10 u
541-73-1	1,3-Dichlorobenzene	10 u
106-46-7	1,4-Dichlorobenzene	10 u
100-51-6	Benzyl Alcohol	10 u
95-50-1	1,2-Dichlorobenzene	10 u
95-48-7	2-Methylphenol	10 u
39638-32-9	bis(2-chloroisopropyl)ether	10 u
106-44-5	4-methylphenol	10 u
621-64-7	N-Nitroso-Di-n-propylamine	10 u
67-72-1	Hexachloroethane	10 u
98-95-3	Nitrobenzene	10 u
78-59-1	Isophorone	10 u
88-75-5	2-Nitrophenol	10 u
105-67-9	2,4-dimethylphenol	10 u
65-85-0	Benzoic Acid	50 u
111-91-1	bis(2-chloroethoxy)methane	10 u
120-83-2	2,4-dichlorophenol	10 u
120-82-1	1,2,4-trichlorobenzene	10 u
91-20-3	Naphthalene	10 u
106-47-8	4-Chloroaniline	10 u
87-68-3	Hexachlorobutadiene	10 u
59-50-7	4-chloro-3-methylphenol	10 u
91-57-6	2-methylnaphthalene	10 u
77-47-4	Hexachlorocyclopentadiene	10 u
88-06-2	2,4,6-Trichlorophenol	10 u
95-95-4	2,4,5-Trichlorophenol	50 u
91-58-7	2-Chloronaphthalene	10 u
88-74-4	2-Nitroaniline	50 u
131-11-3	Dimethyl Phthalate	10 u
208-96-8	Acenaphthylene	10 u
99-09-2	3-Nitroaniline	50 u

CAS Number		ug/l
83-32-9	Acenaphthene	10 u
51-28-5	2,4-Dinitrophenol	50 u
100-02-7	4-Nitrophenol	50 u
132-64-9	Dibenzofuran	10 u
121-14-2	2,4-Dinitrotoluene	10 u
606-20-2	2,6-Dinitrotoluene	10 u
84-66-2	Diethylphthalate	10 u
7005-22-3	4-Chlorophenyl-phenylether	10 u
86-73-7	Fluorene	10 u
100-01-6	4-Nitroaniline	50 u
534-52-1	4,6-dinitro-2-methylphenol	50 u
86-30-6	N-Nitrosodiphenylamine (1)	10 u
101-55-3	4-Bromophenyl-phenylether	10 u
118-74-1	Hexachlorobenzene	10 u
87-86-5	Pentachlorophenol	50 u
85-01-8	Phenanthrene	10 u
120-12-7	Anthracene	10 u
84-74-2	Di-n-butylphthalate	10 u
206-44-0	Fluoranthene	10 u
129-00-0	Pyrene	10 u
85-68-7	Butylbenzylphthalate	10 u
91-94-1	3,3'-Dichlorobenzidine	20 u
56-55-3	Benzo(a)anthracene	10 u
117-81-7	bis(2-Ethylhexyl)Phthalate	10 u
218-01-9	Chrysene	10 u
117-84-0	Di-n-Octylphthalate	10 u
205-99-2	Benzo(b)Fluoranthene	10 u
207-08-9	Benzo(k)Fluoranthene	10 u
50-32-8	Benzo(a)pyrene	10 u
193-39-5	Indeno(1,2,3-cd)Pyrene	10 u
53-70-3	Dibenz(a,h)Anthracene	10 u
191-24-2	Benzo(g,h,i)Perylene	10 u

(1)-Cannot be separated from diphenylamine

APPENDIX I

BATTELLE COLUMBUS - PCDD AND PCDF RESULTS REPORT INCLUDING QA/QC DATA

FINAL REPORT

on

DETERMINATION OF POLYCHLORINATED DIBENZO-P-DIOXINS AND POLYCHLORINATED DIBENZOFURANS IN WATER AND ASH SAMPLES

to

NUS CORPORATION

April 29, 1987

by

M. R. Bauer, M. L. Zimmerman, T. R. Powell, G. E. Pitts,
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April 29, 1987

Dr. Haia Roffman
NUS Corporation
Park West 2
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Dear Dr. Roffman:

We have completed the analyses of the seven water and two ash samples for polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF). These analyses were performed under the terms of Battelle's Proposal/Agreement No. 822-N-0708. I am enclosing a final report which includes our results and a description of the analytical methodology, instrumentation, and quality assurance measures that we employed. Chromatograms from the PCDD/PCDF analyses are included in the appendix.

Please contact me at (614) 424-3913 if you have any questions.

Sincerely,

Mark R. Bauer

Mark R. Bauer, Ph.D.
Research Scientist
Analytical Chemistry Section

MRB:bsf

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FINAL REPORT

on

DETERMINATION OF POLYCHLORINATED DIBENZO-P-DIOXINS AND POLYCHLORINATED DIBENZOFURANS IN WATER AND ASH SAMPLES

to

NUS CORPORATION

from

BATTELLE
Columbus Division

April 29, 1987

INTRODUCTION

The purpose of this report is to present the measured levels of polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) in samples received from NUS on March 3 and March 16, 1987. The report also describes the analytical procedures used to obtain these results. The analytical results for the samples, which consisted of two samples, one ash and one water leachate, from the Onieda County leach field, two similar samples from the New Hanover County leach field, and five water samples collected by Versar Inc., are presented.

ANALYTICAL METHODOLOGY

Sample Extraction

Water Samples. Samples containing sediment were filtered and the sediment saved for extraction. Aliquots of the water were spiked with $^{13}C_{12}$ internal standards to the levels listed below.

Internal Standard	Spike Level
2,3,7,8-tetrachlorodibenzo-p-dioxin-$^{13}C_{12}$ (2,3,7,8-tetra-CDD-$^{13}C_{12}$)	9.5 ng
1,2,3,7,8-pentachlorodibenzo-p-dioxin-$^{13}C_{12}$ (1,2,3,7,8-penta-CDD-$^{13}C_{12}$)	10.0 ng
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin-$^{13}C_{12}$ (1,2,3,6,7,8-hexa-CDD-$^{13}C_{12}$)	9.85 ng
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin-$^{13}C_{12}$ (1,2,3,4,6,7,8-hepta-CDD-$^{13}C_{12}$)	25.8 ng
octachlorodibenzo-p-dioxin-$^{13}C_{12}$ (octa-CDD-$^{13}C_{12}$)	24.8 ng
2,3,7,8-tetrachlorodibenzofuran-$^{13}C_{12}$ (2,3,7,8-tetra-CDF-$^{13}C_{12}$)	9.25 ng
1,2,3,7,8-pentachlorodibenzofuran-$^{13}C_{12}$ (1,2,3,7,8-penta-CDF-$^{13}C_{12}$)	10.25 ng
1,2,3,4,7,8-hexachloro-dibenzofuran-$^{13}C_{12}$ (1,2,3,4,7,8-hexa-CDF-$^{13}C_{12}$)	35.0 ng
1,2,3,4,6,7,8-heptachlorodibenzofuran-$^{13}C_{12}$ (1,2,3,4,6,7,8-hepta-CDF-$^{13}C_{12}$)	23.85 ng

The samples were extracted three times with methylene chloride, the extracts combined, and then concentrated to 5 mL in a Kudurna-Danish apparatus. The dried sediments were added to thimbles containing 0.5 inches of Silica Gel and then extracted with benzene in a soxhlet extractor for 18 hours. The extracts were concentrated to approximately 10 mL with three-stage Snyder columns, and then added to the corresponding water extracts. The combined extracts were then further concentrated to approximately 4 mL.

Ash Samples. Two gram aliquots of ash samples were spiked with the same levels of the tetra- through octa- $^{13}C_{12}$ dioxins and furans used for the water samples. Soxhlet extractors were assembled and the samples extracted for 18 hours with benzene. After extraction, the benzene extracts were concentrated to approximately 4 mL with three-stage Snyder columns.

Extract Cleanup. The extracts were transferred to tandem silica gel columns containing activated silica gel, 44 percent concentrated sulfuric acid on silica gel, and 33 percent 1M sodium hydroxide on silica gel. The purpose of these columns was to remove acidic and basic compounds and easily oxidized materials from the extracts. The silica gel support provided a large surface area for contact with the sample extracts, thus improving the cleanup efficiency. The PCDD/PCDF isomers were eluted from the columns with 70 mL of hexane and the entire eluates, including the original extract volume, were collected. The hexane eluates were concentrated to 2-3 mL with a gentle stream of nitrogen gas.

Elemental sulfur found in sample NY-LE-02 was removed by shaking the extract with an aqueous solution of tetrabutylammonium sulfite until the yellow precipitate dissolved. The hexane layer was removed and then dried by passing it through a four inch column of hexane washed sodium sulfate. The column was eluted with 30 mL of hexane and then concentrated to 2 mL under a stream of nitrogen gas.

All the extracts were then passed onto five gram macro alumina columns and eluted with hexane/methylene chloride (97:3), followed by hexane/methylene chloride (1:1). The 1:1 fractions were concentrated to approximately 2 mL and passed onto one gram micro alumina columns. After elution with 97:3 hexane/methylene chloride, a 1:1 hexane/methylene chloride fractions were collected, concentrated to near dryness under a slow stream of nitrogen and then redissolved in 20 mL of n-decane containing 5 ng of an absolute recovery standard, 1,2,3,4-tetrachlorodibenzo-p-dioxin-$^{13}C_{12}$ (1,2,3,4-tetra-CDD-$^{13}C_{12}$). All solutions were stored at 0 C and protected from light until analysis.

Analysis

The extracts were analyzed and quantified for PCDD/PCDF by combined capillary column gas chromatography/high resolution mass spectrometry (HRGC/HRMS). The HRGC/HRMS system consists of a Carlo Erba Model 4160 gas chromatograph interfaced directly into the ion source of a VG Model 7070 high resolution mass spectrometer. The chromatographic column was a 60 M

DB-5 fused silica column using helium as the carrier gas at a flow velocity of 30 cm/sec. The mass spectrometer was operated in the electron impact (EI) ionization mode at a mass resolution of 9,000-12,000 ($M/\Delta M$, 10 percent valley definition). The operating parameters of the HRGC/HRMS system are summarized in Table 1. All HRGC/HRMS data were acquired by multiple-ion-detection (MID) with a VG Model 11-250J Data System. The exact masses that were monitored are shown in Table 2.

Quality Assurance

The operation of the HRGC/HRMS was evaluated each day by analyzing standard mixtures of PCDD/PCDF isomers. These mixtures consisted of 2,3,7,8-tetra-CDD, 2,3,7,8-tetra-CDF, 2,3,7,8-tetra-CDD-$^{13}C_{12}$, and 2,3,7,8-tetra-CDF-$^{13}C_{12}$ to evaluate accuracy of quantification and to evaluate isomer resolution. Mixtures of selected PCDD/PCDF isomers were used to evaluate the stability of the chromatographic elution windows. The mass focus accuracy of the MID unit was evaluated before each analysis by observing selected ion masses from perfluorokerosene (PFK). Adjustments were made to the offset to correct for minor variations. Mass focus stability was assured by use of a reference PFK "lock mass" to correct for any mass focus drift.

Native spike and a laboratory method blank samples were processed during the extraction and cleanup of the samples. The native spike samples were used to evaluate the accuracy of quantification, while the laboratory method blanks were used to demonstrate freedom from contamination. The results of these analyses are summarized in Table 3. The analyses of the method blanks were free of PCDD/PCDF contamination except for traces of hepta- and octa- CDD/CDF.

Recovery of the spiked PCDD/PCDF standards from the native spike samples ranged from 80-130 percent, which is within the expected range of variation for a sample subjected to extensive chromatographic clean-up.

Recovery of Internal Standards

Recoveries of the internal standards were calculated by comparison to the external standard, 1,2,3,4-tetra-CDD-$^{13}C_{12}$, which was added following extraction. Relative response factors were determined from multiple analyses of a standard mixture containing all of the isotopically labelled standards. The response factors were calculated by comparing the sum of the chromatographic peak areas of the two ions monitored for each chlorine level class to the sum of the peak areas for the two ion masses from 1,2,3,4-tetra-CCD-$^{13}C_{12}$. The experimental relative response factors were:

Congener Class	Response Factor
Tetra-CDD	1.19
Penta-CDD	0.59
Hexa-CDD	1.00
Hepta-CDD	0.71
Octa-CDD	0.64
Tetra-CDF	1.28
Penta-CDF	1.66
Hexa-CDF	1.60
Hepta-CDF	1.16

The equation used to calculate the recoveries was:

$$\text{Recovery (\%)} = \frac{Ais \times Qrs \times 100}{Ars \times Qis \times Rf}$$

Where:

Ais = Sum of integrated areas for internal standard;
Qrs = Quantity of recovery standard in ng;
Ars = Sum of integrated areas for recovery standard;
Qis = Quantity of internal standard in ng; and
Rf = Response factor.

Quantification

The PCDD/PCDF were quantified by comparing the sum of the chromatographic peak areas for the two ions monitored in each congener class to the sum of the peak areas of the two ions monitored for the corresponding isotopically labelled isomer. The octa-CDD-$^{13}C_{12}$ was used to quantify the octa-CDF.

Experimental relative response factors were calculated from seven analyses of a standard mixture which contains representatives from each of the tetrachloro- through octachloro- PCDD/PCDF congener classes and their corresponding $^{13}C_{12}$ isotopes. These response factors were included in all calculations used to quantify the data. The response factors were calculated by comparing the sum of the chromatographic peak areas of the two ions monitored for each congener class to the sum of the peak areas for the two ions monitored for the corresponding isotopically labelled internal standard. The experimental response factors were:

Congener Class	Response Factor
Tetra-CDD	0.99
Penta-CDD	0.97
Hexa-CDD	1.05
Hepta-CDD	0.93
Octa-CDD	0.94
Tetra-CDF	0.91
Penta-CDF	1.03
Hexa-CDF	1.05
Hepta-CDF	0.97
Octa-CDF	0.92

The formula used for quantifying the PCDD/PCDF isomers was:

$$\text{Concentration} = \frac{Ac \times Qis}{Ais \times W \times Rf}$$

Where:

Conc. = Concentration of target isomer or congener class

Ac = Sum of integrated peak areas for the target isomer or congener class

Qis = Quantity of internal standard

Ais = Total integrated peak areas for the internal standard

W = Sample weight in g

Rf = Response factor.

Each resolved peak present in the pair of selected-ion-current chromatograms collected for each congener class was evaluated manually to determine if it met the criteria for a PCDD or PCDF isomer. By examining each of the peaks separately, quantitative accuracy is improved over what is obtained when the areas of all of the peaks in a selected chromatographic window are averaged. When averaged data are used, it is possible for pairs of peaks with high and low chlorine isotope ratios to produce averaged data that meets the isotope ratio criterion. For example, two pairs of peaks having chlorine isotope ratios of 0.56 and 0.96, which are outside of the acceptable range, calculate to an average ratio of 0.76, which is in range.

The criteria that were used to identify PCDD and PCDF isomers were:

(1) Simultaneous responses in both ion chromatograms

(2) Chlorine isotope ratio within ± 15% of the theoretical value

(3) Chromatographic retention times within windows determined from analyses of standard mixtures

(4) Signal-to-noise ratio equal to or greater than 2.5 to 1

The 2,3,7,8-substituted PCDD/PCDF isomers and the octa-CDD included the additional criterion that they coeluted within ±2 seconds of their isotopically labelled analogs.

A limit of detection (LOD) was calculated for samples in which isomers of a particular chlorine congener class were not detected. The formula used for calculating the LOD was:

$$\text{LOD} = \frac{\text{Hn} \times \text{Qis} \times 2.5}{\text{His} \times \text{W} \times \text{Rf}}$$

Where:

LOD = Single isomer limits of detection for a congener class
Hn = Average height of background noise
Qis = Quantity of internal standard
His = Peak height of internal standard
W = Sample weight
Rf = Response factor; and
2.5 = Signal-to-noise ratio.

RESULTS

The results from the PCDF/PCDD analyses are summarized in Table 3. These data are the actual measured levels in the samples and have not been corrected for laboratory or field blank levels. They have been corrected, however, for extraction efficiency and cleanup losses. A detection limit is listed, in parentheses, for samples in which a particular chlorine congener class was not detected. The concentration of the 2,3,7,8-substituted PCDD/PCDF which coeluted with the internal standards are also given in Table 3. However, on the DB-5 capillary gas-chromatography column, the 2,3,7,8-tetra-CDF is not easily resolved from certain other isomers in the same congener class, and thus, may contain contributions from other isomers. For example, 2,3,7,8-tetra-CDF may coelute with 1,2,4,9-tetra-CDF, 2,3,4,7-tetra-CDF, 2,3,4,8-tetra-CDF, and 2,3,4,6-tetra-CDF. To further resolve tetra-CDF isomers, a second gas chromatographic column can be used, however this is beyond the scope of the present study.

The recoveries of the internal standards are summarized in Table 4. The recovery of tetra- through octa- CDD/CDF averaged 80-130 percent, which is within the expected range of recoveries for samples subjected to multiple chromatographic cleanups. Chlorine isotope ratios for samples that contained PCDD/PCDF isomers are summarized in Table 5, and all met acceptance criteria.

The single ion current chromatograms for the sample, standard, and decane analyses are included separately in the Appendix. The data files are labelled with a 7-letter-digit combination, with the beginning letter identifying the instrument used, and the first two numbers denoting the instrument logbook in which the analysis is recorded. The third and fourth numbers denote the page in the logbook and the fifth and sixth numbers the line on which the entry was made.

TABLE 1. HRGC/HRMS OPERATING PARAMETERS

Mass Resolution	9,000-12,000 ($M/\Delta M$, 10% valley definition)
Electron Energy	70 eV
Accelerating Voltage	6,000 Volts
Source Temperature	200 C
Preamplifier Gain	10^{-7} amps/volt
Electron Multiplier Gain	$\sim 10^{6}$
Transfer Line Temperature	280 C
Column	DB-5 60M
Injector Temperature	300 C
Column Temp - Initial	160 C Hold for 2 min
Column Temp - Program	20 C/min to 240 C hold for 30 min 20 C/min to 320 C hold for 20 min
Carrier Gas	Helium
Flow Velocity	~30 cm/sec
Injection Mode	Splitless
Injection Volume	2 μL

TABLE 2. EXACT MASSES USED FOR THE DETERMINATION OF PCDD AND PCDF

Compound	Accurate Mass Mass 1	 Mass 2	Theoretical Isotope Ratio Mass 1/Mass 2
Tetrachlorodibenzo-p-dioxins	319.8965	321.8936	0.77
Tetrachlorodibenzofurans	303.9016	305.8987	0.77
Pentachlorodibenzo-p-dioxins	355.8546	357.8517	1.54
Pentachlorodibenzofurans	339.8597	341.8567	1.54
Hexachlorodibenzo-p-dioxins	389.8156	391.8127	1.23
Hexachlorodibenzofurans	373.8207	375.8178	1.23
Heptachlorodibenzo-p-dioxins	423.7766	425.7737	1.03
Heptachlorodibenzofurans	407.7817	409.7788	1.03
Octachlorodibenzo-p-dioxins	457.7377	459.7347	0.88
Octachlorodibenzofurans	441.7428	443.7398	0.88
Tetrachlorodibenzo-p-dioxin-$^{13}C_{12}$	331.9367	333.9338	0.77
Tetrachlorodibenzofuran-$^{13}C_{12}$	315.9418	317.9389	0.77
Pentachlorodibenzo-p-dioxin-$^{13}C_{12}$	367.8948	369.8918	1.54
Pentachlorodibenzofuran-$^{13}C_{12}$	351.8999	353.8969	1.54
Hexachlorodibenzo-p-dioxin-$^{13}C_{12}$	401.8558	403.8529	1.23
Hexachlorodibenzofuran-$^{13}C_{12}$	385.8609	387.8580	1.23
Heptachlorodibenzo-p-dioxin-13C12	435.8168	437.8139	1.03
Heptachlorodibenzofuran-13C12	419.8219	421.8190	1.03
Octachlorodibenzo-p-dioxin-$^{13}C_{12}$	469.7779	471.7749	0.88

TABLE 3. LEVELS OF PCDD/PCDF IN SAMPLES

Sample Number	Units	2,3,7,8-TETRA -CDD	TOTAL TETRA -CDD	TOTAL PENTA -CDD	TOTAL HEXA -CDD	TOTAL HEPTA -CDD	OCTA -CDD
23002 TCLP -NC	pg/L	(27)	(27)	(16)	(7.3)	(18)	(48)
23002SW924	pg/L	(42)	(42)	(16)	(4.8)	(23)	35
23002EP-TOX	pg/L	(53)	(53)	(13)	(4.9)	21	31
NC-LE-02	pg/L	(46)	(46)	(64)	130	770	15000
NY-LE-02	pg/L	(57)	(57)	(23)	47	120	210
METHOD BLANK	pg/L	(17)	(17)	(15)	(6.2)	17	18
22392EP-TOX -NY	pg/L	(83)	(83)	(31)	(10)	(29)	33
22392 TCLP	pg/L	(27)	(27)	(25)	(6.7)	(20)	(32)
NATIVE SPIKE	pg/L	21000	21000	9900	8400	10000	4300
METHOD BLANK	pg/L	(37)	(37)	(17)	(12)	30	(33)
NC-ASH-01	ng/g	(0.02)	0.03	0.10	0.1	0.18	0.14
NY-ASH-01	ng/g	(0.02)	0.02	0.12	0.43	4.2	9.9
NATIVE SPIKE	ng/g	18	18	8.5	6.9	9.0	4.0
METHOD BLANK	ng/g	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	0.02

TABLE 3. (CONTINUED)

Sample Number	Units	2,3,7,8-TETRA -CDF[a]	TOTAL TETRA -CDF	TOTAL PENTA -CDF	TOTAL HEXA -CDF	TOTAL HEPTA -CDF	OCTA -CDF
23002 TCLP NC	pg/L	(33)	(33)	(8.8)	(7.0)	(8.9)	(80)
23002SW924	pg/L	(23)	(23)	(5.4)	(4.4)	(6.2)	(41)
23002EP-TOX	pg/L	(19)	(19)	(4.0)	(8.9)	12	(51)
NC-LE-02	pg/L	(75)	(75)	35	35	85	54
NY-LE-02	pg/L	(45)	(45)	28	41	43	23
METHOD BLANK	pg/L	(15)	(15)	(3.6)	(5.2)	4.2	(18)
22392EP-TOX NY	pg/L	(36)	(36)	(6.7)	(7.2)	(19)	(47)
22392 TCLP	pg/L	(14)	(14)	(6.2)	(6.9)	(12)	(68)
NATIVE SPIKE	pg/L	10000	10000	9700	10000	9900	9900
METHOD BLANK	pg/L	(27)	(27)	(5.2)	(2.8)	4.7	(36)
NC-ASH-01	ng/g	0.07	0.56	0.29	0.19	0.11	0.02
NY-ASH-01	ng/g	0.11	0.46	0.54	1.2	2.2	1.7
NATIVE SPIKE	ng/g	8.9	8.9	8.4	8.2	8.7	8.8
METHOD BLANK	ng/g	(0.01)	(0.01)	(0.003)	0.005	(0.003)	0.13

[a] May include contributions from four additional tetra-CDF isomers

TABLE 4. PERCENT RECOVERIES OF INTERNAL STANDARDS

Sample	TETRA -CDD	PENTA -CDD	HEXA -CDD	HEPTA -CDD	OCTA -CDD	TETRA -CDF	PENTA -CDF	HEXA -CDF	HEPTA -CDF
23002 TCLP	94	100	110	91	99	98	91	99	100
23002SW924	100	110	110	97	100	100	99	100	110
23002EP-TOX	96	110	110	96	83	92	100	88	110
NC-LE-02	99	96	100	94	97	100	92	93	100
NY-LE-02	110	80	93	100	120	110	96	110	100
METHOD BLANK	110	120	110	110	100	110	100	100	120
22392EP-TOX	92	91	95	87	90	92	88	89	96
22392 TCLP	100	110	100	98	100	100	94	95	100
NATIVE SPIKE	100	110	110	120	130	94	100	100	130
METHOD BLANK	110	100	110	110	140	100	100	120	120
NC-ASH-01	91	92	100	100	110	93	87	95	99
NY-ASH-01	100	110	120	120	130	110	92	100	120
NATIVE SPIKE	100	110	120	120	110	98	94	110	130
METHOD BLANK	99	100	110	110	120	92	92	100	120

TABLE 5. CHLORINE ISOTOPE RATIOS
(Theoretical Chlorine Isotope Ratio)

Sample Number	2,3,7,8-TETRA -CDD (0.77)[1]	TOTAL TETRA -CDD (0.77)	PENTA -CDD (1.54)	HEXA -CDD (1.23)	HEPTA -CDD (1.03)	OCTA -CDD (0.88)
	[illegible]	[illegible]	1.31 - 1.77	1.05 - 1.41	.88 - 1.18	.75 - 1.01
23002 TCLP	---	---	---	---	---	---
23002SW924	---	---	---	---	---	0.83
23002EP-TOX	---	---	---	---	1.01	0.99
NC-LE-02	---	---	---	1.26	0.98	0.92
NY-LE-02	---	---	---	1.31	1.05	0.78
METHOD BLANK	---	---	---	---	0.96	0.96
22392EP-TOX	---	---	---	---	---	0.98
22392 TCLP	---	---	---	---	---	---
NATIVE SPIKE	0.79	0.79	1.61	1.25	1.03	0.88
METHOD BLANK	---	---	---	---	1.09	---
NC-ASH-01	---	0.80	1.43	1.41	0.97	0.91
NY-ASH-01	---	0.78	1.63	1.20	1.05	0.89
NATIVE SPIKE	0.78	0.78	1.60	1.23	1.05	0.90
METHOD BLANK	---	---	---	---	---	0.76

--- Congener class not detected in sample.

[1] Expected theoretical value in parentheses.

TABLE 5. (CONTINUED)

Sample Number	2,3,7,8-TETRA -CDF (0.77)[1]	TOTAL TETRA -CDF (0.77)	PENTA -CDF (1.54)	HEXA -CDF (1.23)	HEPTA -CDF (1.03)	OCTA -CDF (0.88)
23002 TCLP	---	---	---	---	---	---
23002SW924	---	---	---	---	---	---
23002EP-TOX	---	---	---	---	0.93	---
NC-LE-02	---	---	1.51	1.31	1.09	1.01
NY-LE-02	---	---	1.40	1.14	1.11	0.94
METHOD BLANK	---	---	---	---	1.09	---
22392EP-TOX	---	---	---	---	---	---
22392 TCLP	---	---	---	---	---	---
NATIVE SPIKE	0.77	0.77	1.58	1.28	1.02	0.94
METHOD BLANK	---	---	---	---	1.05	---
NC-ASH-01	0.78	0.79	1.52	1.25	1.03	0.90
NY-ASH-01	0.79	0.79	1.55	1.25	1.06	0.92
NATIVE SPIKE	0.77	0.77	1.46	1.25	1.04	0.91
METHOD BLANK	---	---	---	1.31	---	1.00

--- Congener class not detected in sample.
[1] Expected theoretical value in parentheses.